Distribution of Pollock (*Pollachius virens*) Eggs and Larvae on the Scotian Shelf, Eastern Gulf of Maine, Bay of Fundy and Eastern Georges Bank

A. R. Hanke, F. H. Page and J. Neilson

Fisheries and Oceans Canada
Biological Station
531 Brandy Cove Road
St. Andrews, NB E5B 2L9

March 2001

Canadian Technical Report of Fisheries and Aquatic Sciences 2345

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Technical Report of
Fisheries and Aquatic Sciences

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Department of Fisheries and Oceans
Biological Station
531 Brandy Cove Road
St. Andrews, NB, E5B 2L9 Canada

This is two hundred and forty-second Technical Report of
the Biological Station, St. Andrews, N.B.

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Cat. No. Fs 97-6/2345E ISSN 0706-6457

Correct citation for this publication:

Hanke, A. R., F. H. Page, and J. Neilson. 2001. Distribution of pollock (*Pollachius virens*) eggs and larvae on the Scotian Shelf, eastern Gulf of Maine, Bay of Fundy and eastern Georges Bank. Can. Tech. Rep. Fish. Aquat. Sci. 2345: iii +120 p.

101-03781/

ABSTRACT

Hanke, A. R., F. H. Page, and J. Neilson. 2001. Distribution of pollock (*Pollachius virens*) eggs and larvae on the Scotian Shelf, eastern Gulf of Maine, Bay of Fundy and eastern Georges Bank. Can. Tech. Rep. Fish. Aquat. Sci. 2345: iii + 120 p.

The temporal and spatial distribution of sampling and the sampling protocols used for pollock during the Canadian Department of Fisheries and Oceans Larval Herring (LHP), Scotian Shelf Ichthyoplankton (SSIP) and Fisheries Ecology Programs (FEP) are summarized. In addition, the spatial distributions of Stage I, II, III and IV pollock eggs and 1 to 7 mm and >7 mm pollock larvae are presented for each survey and are aggregated over all programs and time to form general and bimonthly composites. To avoid standardizing the sampling effort for differences among sampling protocols and gear types used in the survey programs, the distributions of pollock early life history stages were determined using a presence/absence criterion rather than the actual abundance. The samples selected from the LHP database were those collected using a 61cm Bongo outfitted with either 505- or 333-µm mesh and towed in a saw tooth fashion. The FEP is represented by Bongo samples taken with a 333-µm mesh and a double oblique tow only and the SSIP is also represented by Bongo samples collected with a 471-µm mesh and an old stepped oblique tow.

RÉSUMÉ

Hanke, A. R., F. H. Page, and J. Neilson. 2001. Distribution of pollock (*Pollachius virens*) eggs and larvae on the Scotian Shelf, eastern Gulf of Maine, Bay of Fundy and eastern Georges Bank. Can. Tech. Rep. Fish. Aquat. Sci. 2345: iii + 120 p.

Le présent document résume la distribution temporelle et spatiale des échantillons et des protocoles d'échantillonnage utilisés pour le goberge dans le cadre de trois programmes du ministères canadien des Pêches et des Océans, soit le Programme d'étude des larves de hareng (PELH), le Programme d'étude de l'ichtyoplancton de la plate-forme néo-écossaise (PEIPFNE) et le Programme de l'écologie des pêches (PEP). En outre, on présente des données sur la distribution spatiale des œufs de goberge aux stades I, II, III et IV et des larves de goberge mesurant de 1 à 7 mm et de >7 mm. Ces données sont présentées pour chaque relevé puis sont regroupées pour l'ensemble des programmes et réparties sur toute la période pour former des moyennes composées bimestrielles. Afin d'éviter de normaliser l'effort d'échantillonnage pour ce qui est des différences entre les protocoles d'échantillonnage et les types d'engins utilisés dans les programmes de relevé, les distributions de la goberge aux stades précoces ont été déterminées au moyen de critères de détection d'indicateurs de présence ou d'absence plutôt qu'en fonction des effectifs réels. Les échantillons prélevés dans le cadre du Programme d'étude des larves de hareng ont été prélevés au moyen d'un filet Bongo de 61 cm, ayant un maillage de 505 ou de 333 µm, et moyennant des traits en forme de dents de scie. Le PEP est représenté par des échantillons Bongo prélevés au moyen d'un filet au maillage de 333 µm et de traits doubles obliques uniquement et le PEIPFNE est représenté par des échantillons Bongo prélevés au moyen d'un filet de maillage de 471 µm et d'un traits obliques par paliers.

INTRODUCTION

The purpose of this report is to make the temporal and spatial distribution of pollock eggs and larvae, contained within three Canadian ichthyoplankton survey programs, readily available for quick visual perusal. Hence, the report briefly describes each survey program and the scope of the data. It also combines the information from all surveys into bimonthly and single composites for each early life stage to highlight the major temporal and spatial patterns in distribution, and presents stage-specific distribution plots for each individual survey within each program for more detailed reference. Investigators wishing to pursue more detailed analyses should extract the data from relevant databases.

Ichthyoplankton data have been used for a variety of fisheries-related studies. For example, Gagné and O'Boyle (1984) and O'Boyle et al. (1984) used Scotian Shelf Ichthyoplankton Program (SSIP) data to test hypotheses of larval retention, noting that for many species of fish occurring on the Scotian Shelf, both the eggs and larvae appear to be retained over the banks for considerable periods. Neilson and Hurley (1986), Neilson et al. (1986), Neilson et al. (1988) and Hunt and Neilson (1993) employed the data to elucidate stock structure of flatfish and gadids in Maritime waters. Hurley and Campana (1989) examined the Fisheries Ecology Program (FEP) data to describe the distribution of early life history stages of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). However, no one work has aggregated all available ichthyoplankton data for pollock (*Pollachius virens)* in the Maritimes Region in a comprehensive manner.

MATERIALS AND METHODS

DATA SOURCES

The data pertaining to the distribution of the early life stages of pollock on the Scotian Shelf, eastern Gulf of Maine and the Bay of Fundy has been compiled from three Canadian Department of Fisheries and Oceans icthyoplankton survey programs conducted during the 1970s, 1980s and 1990s. These programs were the Larval Herring Program (LHP), the Scotian Shelf Ichthyoplankton Program (SSIP) and the Fisheries Ecology Program (FEP). An overview of the temporal and spatial coverage of each of these survey programs is given in Table 1 (note that the survey-specific distribution plots described in the following results sections provide a good view of the relative spatial coverage of each survey). A more detailed description of each program is given below.

Larval Herring Program

The Larval Herring Program (LHP) is an ichthyoplankton survey that has been conducted using standardized procedures since 1972 (Iles et al. 1985). This report includes only surveys conducted until 1997. Survey coverage focused on the Bay of Fundy, the area off southwest Nova Scotia, and Georges Bank (Fig. 1). In the Bay of Fundy (BoF), spring and fall surveys were conducted each year from 1975 to 1984. Starting in 1985, the program was reduced to only one fall survey per year (Table 2). The Georges Bank (GB) surveys began in 1987 and ended in 1997 and consisted of a single fall survey each year (Table 3). Seasonal coverage for the BoF and GB surveys is depicted in Fig. 2 and 3. Data from the surveys are stored in an ORACLE database residing at the St. Andrews Biological Station, New Brunswick, Canada.

The original purpose of the LHP was to increase knowledge of the ecology of herring larvae, and was designed to coincide with the larval abundance peak resulting from an assumed spawning peak of September 1 (Iles et al. 1985). Since 1981, the larval abundance index (LAI), based on 79 standard LHP stations, has been used in analyses for the 4WX herring stock assessment. Since the focus of the LHP was on herring, not all samples were sorted for species other than herring. Hence, there are some BoF and GB surveys not included in the distribution plots. All known exceptions are noted in Table 4.

The sampling scheme for the Bay of Fundy surveys initially followed a standard grid of 116 stations (numbered 001-116). Stations on the grid were meant to be 10 nautical miles apart, but for practical reasons some are only 5 mi apart. Sampling was carried out within ±0.5 mi from the master station coordinates.

Over the years, the grid was expanded to 163 stations, with a number of additional random

stations added periodically. In 1988, 1989, and 1990, 80 random stations were added to compare with results obtained from regular grid stations. The 80 random stations were added in an area of traditionally high herring larval density off southwest Nova Scotia (Stephenson et al. 1990).

The Georges Bank surveys within the Larval Herring Program followed a different sampling scheme. In this program, sample stations were allocated within a grid of 20 x 20 nautical mile blocks. Beginning in 1988 this allocation was done on a random basis.

Scotian Shelf Ichthyoplankton Program

The Scotian Shelf Ichthyoplankton Program was conducted during the years 1976-82. This program was designed "to provide basic information on the spatial and temporal distribution of eggs and larvae on the Scotian Shelf as an aid to the better management of the fishery." (O'Boyle et al. 1984). The data are maintained within an ORACLE database at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia. Detailed descriptions of the program and the data set are given in Anon. (1989). A brief summary of the program is given below with an emphasis on the surveys and sampling procedures used to collect the data analysed in this report.

The SSIP data set includes 39 surveys. Each survey covered the Scotian Shelf to some degree (Fig. 1). Five of the surveys were not included in the present analyses (Table 5) since the data associated with these were not appropriate for the present purpose. Three of these surveys were primarily patch studies focused on the limited geographic region of Emerald and Western Banks and two surveys targeted silver hake. The data for the remaining 34 surveys (Table 6) were available and were included in the present analyses. The temporal coverage by these surveys is presented in Fig. 4.

Surveys conducted prior to 1977 consisted of a grid of 150 consecutive stations covering the Scotian Shelf from the Laurentian to the Northeast Channel. Beginning in 1977, a conventional sampling grid approach (the "Standard Transect Grid") covering the Scotian Shelf, parts of the continental slope and Georges Bank, and the northeastern half of the Gulf of Maine was adopted. The objective was to mirror the California Cooperative Oceanic Fisheries Investigations (CalCOFI) survey design and, in particular, to achieve standardization with the Marine Resources, Monitoring, Assessment and Prediction (MARMAP) survey on the US East Coast. The grid consisted of 40 transect lines running perpendicular to the Nova Scotian coast, 15 miles apart. Stations along each transect were located at depth discontinuities. There were between 3 and 11 stations along each transect. In 1978, standardized procedures were adopted and a total of 245 stations were sampled. From 1979-82, the sampling protocol was reduced to 150 primary stations in order to save time and help ensure the entire survey domain was sampled by each survey.

Fisheries Ecology Program

The Fisheries Ecology Program was initiated by the Marine Fish Division of the Canadian Department of Fisheries and Oceans to learn more about the ecology of the commercially important gadoid species, particularly haddock, on the southwestern Scotian Shelf (Smith et al. 1989). The surveys covered the Scotian Shelf off southwest Nova Scotia (Fig. 1). Yearly, five surveys were conducted from 1983-85 (Table 7), for a total of 15. In each year, the surveys were conducted monthly from February through June (Fig. 5).

The initial 1983 sampling scheme for the survey consisted of a grid composed of 11 transects and 85 stations in total. The stations were approximately 28 km apart for most of the survey domain and somewhat closer over the western portion of Brown's Bank. In 1984 and 1985, two additional transects were added that traversed Brown's Bank. There were 6 stations in each new transect for a total of 97 stations (Hurley and Campana 1989). The data are stored in an ORACLE database maintained at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

Sample storage identification and protocols

Many thousands of plankton samples were collected during the LHP, SSIP and FEP (Table 8, 9, 10, 11). The range of sampling approaches included vertical hauls with a 0.5- or 1-m diam. net, oblique and saw tooth tows with a 61-cm Bongo or Isaacs-Kid net to within 5 m off the bottom or 200 m maximum depth and surface tows

with a 61-cm Bongo or Neuston net. Of these approaches, only the Bongo tows were processed for ichthyoplankton and only the information from the saw tooth and oblique Bongo tows was used in the present analyses. Tow depths were determined by a conductivity-temperature-depth (CTD) recorder attached above the Bongo frame. A flow meter attached inside the mouth of the net measured the volume of water filtered through the nets during each tow. The nets were towed at a target speed of 2.5 knots (1.3 $m \cdot s^{-1}$), lowered and retrieved at wire out and in rates of 20 and 50 $m \cdot min^{-1}$, respectively. A range of mesh sizes was also used with each gear type (Table 8, 9, 10, 11). More than 90% of the port samples and less than 50% of the starboard samples were processed for fish eggs and larvae. During the FEP in 1984 and 1985, replicate Bongo samples were taken immediately after completion of the first tow by returning to the initial starting location and redeploying the Bongo gear. These replicate tows accounted for 67% of the stations sampled during the FEP. The starboard samples were generally sorted to compare the catches from port and starboard nets and when the port sample was unavailable. Rather than use the information from both replicate tows and both sides of the Bongo, when these were available, only the information from the port side of one sample was used in the present analyses. However, in cases where a port sample was not available, a starboard sample, if available, was used instead.

The fish eggs and larvae from each sample were classified into four developmental stages (Table 12) and identified to species when possible. The larvae were measured to the nearest millimeter. Samples containing more than 200 eggs were sub-sampled using the beaker split method of Van Guelpen et al. (1982).

DATA ANALYSES

Type of data extracted

From the above surveys, certain data records were not selected because they were associated with undesirable fish and egg identification protocols (fishproc codes 2, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16; Table 13). This restriction eliminated entire surveys from the LHP program as indicated in previous sections (Tables 4 and 5). Acceptable fishproc codes included 1, 3, 4, 6 and 7. There was only one survey (P193) to record a single catch of pollock when fishproc was 6 (identified and counted selected fish and no fish eggs). When fishproc was 3 (identified and counted all fish and no fish eggs) only larval plots were generated (e.g. surveys P151 and P217). When fishproc was 4 (identified and counted selected fish and all fish eggs) or 7 (identified and counted no fish and all fish eggs) only egg stage plots were created. Fishproc 1 yielded both larval and egg stage plots.

Of the remaining records, those samples originating from a 61 cm bongo (geartype=94), towed according to the saw tooth (gearproc=7), old stepped oblique (gearproc=4) or MARMAP double oblique (gearproc=3) procedures, were retained. This selection resulted in all the acceptable LHP surveys being saw tooth bongos and all SSIP/FEP surveys being MARMAP double oblique bongos except surveys P170, P182, CL01, FT01, CC01 and CC02 which were old stepped oblique bongo tows.

Valid net mesh sizes for the bongo tows were limited to 333, 471 and 505 µm. Preference was given to the smallest mesh available and the port side sample. If these criteria were associated with more than one sample/set, the record with the smallest sample number was selected. The 471-µm mesh was used exclusively for bongo tows in surveys P182, CL01, CC01 and CC02.

Records were also rejected according to their method of sample preservation. When sampcura, the database field for sample processing, was null, 1 or 99, the record was discarded because the sample was considered damaged, lost or unrepresentative.

Finally, each record was associated with a station identifier, set number, date and geographic position. The position of a station was reduced to the minimum latitude and longitude for the minimum set number, since several tows may be associated with each set and multiple sets with each station. In the case of Bay of Fundy surveys, random and special additional stations were omitted (those stations beginning with R or A) because they were added in only 3 yr in areas of traditionally high herring density off the coast of southwest Nova Scotia and did not enhance the geographic or temporal coverage. The "A" series

stations yielded 8 pollock egg and 6 pollock larvae locations and the "R" series stations yielded 18 egg and 49 pollock larvae locations.

Presence/absence plots

A presence/absence approach was considered the best way for visualizing the general patterns in pollock distributions. Distributions represented by abundance at location are unduly influenced by those locations where large numbers are caught. Even log-scale transformations cannot reduce the visual impact that these high catches have on the perception of pollock distribution. The equal weighting that a binary approach attributes to each location where pollock were found may be a more appropriate way of dealing with inadequacies in the sampling grid.

Temporally, a binary representation is also more robust. Complex physical processes control the distribution of ichthyoplankton on a continuing basis. Yet, abundance-based distributions present the data as though it came from a static environment without a significant temporal component incorporated in the sampling. The binary approach devalues the significance timing has on the perceived distribution of pollock eggs and larvae since only areal issues are important.

For those situations where samples have various collection histories, abundance based distribution plots should not be produced without first transforming the samples to a common collection protocol (sampling effort). Standardization may not always be possible since the conversion relationships are not always known. A presence/absence approach minimizes the standardization issue because knowledge of relative abundance is not required.

Distribution plots of the presence and absence of each early life stage were plotted for each individual survey. To help extract robust features in the temporal and spatial distribution of the early life stages the data were also aggregated into a single distribution plot and bimonthly plots for each stage. All plots depict the location of the target species given the data selection criteria described above. For the composite plots, i.e. the plots of aggregated data, the presence of the target species was shown when more than one egg or larva was counted in a sample. This elevated detection threshold was established to decrease the likelihood of plotting misclassified eggs or larvae or outliers in both space and time. The overall outcome was a more compact plot of species distribution that showed more coherence from month to month and among stages.

A shortcoming of the plots is their ability to mislead the eye when comparing regions with unequal sample densities. This problem is particularly evident when comparing the eastern Scotian Shelf with either Georges Bank or the Bay of Fundy at certain times of the year.

RESULTS

GENERAL COMPOSITE (Fig. 6)

The general composite plots identify the geographical extent of the early life stages of pollock ichthyoplankton aggregated over all programs, seasons and years. Interpretation of these plots should take into consideration the precautionary notes described in the next section.

It is obvious from these plots that the Stage II eggs, Stage IV eggs and larvae >7 mm were not detected with the same frequency as the other life stages. The reasons for this are not clear. This occurrence may be induced by differential development times between stages, problems with classification or may reflect the influence of biological and physical processes on the above.

The prime spawning areas as inferred from the spatial extent of Stage I pollock eggs were Georges Bank, Browns Bank, coastal Nova Scotia and the shelf off southwest Nova Scotia. From examination of Stage I eggs, the eastern Scotian Shelf does not register as a spawning site. In later stages, eggs were detected on Emerald, Western, Sable Island and Banquereau Bank. The fidelity of the succeeding life stages to the above locations is relatively good up to larvae >7 mm. Georges Bank was one location for which successive life stages declined in occurrence faster than adjacent areas. This effect could have resulted from a narrow temporal sampling window or from spatial shifts in occurrence. One other example of a spatial shift in occurrence was observed in the plot of larvae >7 mm. Where preceding life stages were observed off southwest Nova Scotia, larvae >7 mm occurred in

an adjoining area in the Bay of Fundy. With the abundance of occurrences alternating between life stages it was difficult to identify any other examples of spatial shifts in the distribution of pollock life stages.

BIMONTHLY COMPOSITES (Fig. 7.1-7.6)

These plots are a refinement of the general composite plot in that for each life stage, occurrence is separated into bimonthly periods. From these plots it is possible to observe how occurrence varies spatially by comparing regions and temporally by comparing all periods within a single life stage or all life stages within a single period.

Before the bimonthly plots are described (Fig. 7.1-7.6), a cautionary note regarding the sampling intensity in each season is warranted. Upon examination of the survey dates for each program, one will note that the sampling intensity is not even throughout the year (Tables 2,3,6,7 and Fig. 2-5). The FEP only has data from February 1 to June 21 in 3 yr, 1983-85. The GB arm of the LHP sampled October from 1987-91 and November from 1992-97. The BoF arm of the LHP, in addition to sampling in October/November from 1975-97, sampled March from 1975-84 and August from 1977-80. The SSIP sampled in virtually every week of the year, but the majority of effort was centered on the period between August 1 and September 31 from 1975-82 and in the remainder of the year some months may only be sampled in 1 or 2 yr. Thus, when the data from all programs is aggregated into bimonthly plots, the FEP and BoF are the main contributors to the March-April plot while the fall BoF surveys and GB surveys are the main contributors to the November-December plot. The July-August plot gets some data from the BoF surveys but more from the SSIP. The remaining plots have a large SSIP/FEP component. Also, some of these plots are supported by an unbroken time series while others represent a short segment of time. In fact, the points on the plot will also have a hidden degree of sampling where the same location is visited in multiple years but is represented by a single point. Consequently, comparisons between plots for different months should be done with the understanding that some plots have had a higher level of sampling which may give the impression of more eggs or larvae. Comparisons between stages for the same bimonthly period are more appropriate.

The Stage I plots indicate that spawning probably occurred in several locations and times within a year. In September-October many Stage I eggs were found over Browns Bank and off southwest Nova Scotia. Occurrence on Browns Bank persisted until May-June while southwest Nova Scotia had relatively few occurrences by January-February. The next significant area to yield eggs was Georges Bank in November-December. Thereafter, it was under-sampled and yielded few eggs. No eggs were observed in July and August.

Stage II plots had a pattern of occurrence similar to Stage I except that no eggs were detected between March and August and Emerald Bank had a significant number of sites with eggs from November to February.

The locations occupied by Stage III eggs were consistent with those noted for Stage I and II. The southwest Nova Scotia group was first observed in September-October and persisted until March-April. The Browns and Georges Bank patches had a similar duration but the peak seemed to vary among locations. On the Scotian Shelf, Stage III eggs were observed on the Emerald/Western/Sable Island Bank in November-December and only on Emerald Bank and Banquereau Bank in January-February. No eggs were observed from May to August.

There were relatively few Stage IV eggs detected. Where they did occur, they were in areas and times consistent with the occurrence of earlier egg stages. Larvae 1-7 mm long were detected off southwest Nova Scotia and on the Emerald/Western/Sable Island Banks. A feature of the plots for these larvae was their absence on Georges Bank in all months except March-April. Elsewhere, the peak time of occurrence of larvae 1-7mm long was similar to that observed for Stage III eggs. The southwest Nova Scotia group had a peak spatial extent in November-December; Browns Bank in January-February; Western/Sable Island Bank in November-December and Emerald Bank in January-February.

Larvae >7 mm long departed from the typical spatial and temporal patterns described for the earlier stages. Large larvae were absent

between July and December. In January-February, two sites near Browns Bank and two on Sable Island Bank had larvae. The remaining six sites were located on or near Emerald Bank. Only the Emerald Bank sites corresponded well with where earlier stages were found. Earlier life stages were found off southwest Nova Scotia but virtually no larvae >7 mm were detected there. Approximately four locations between March and June yielded larvae >7 mm in the southwest Nova Scotia region. In an adjacent area at the mouth of the Bay of Fundy, many large larvae were observed in March-April. No large larvae were detected on Georges Bank.

SURVEY-SPECIFIC DISTRIBUTIONS

LHP-Bay of Fundy (Fig. 8.1.1-8.1.6)

The BoF surveys were short in duration, about 11 d, and were conducted over a very narrow temporal window in the fall ranging from the last week in October to the second week in November. The spring surveys were also short and mainly occurred in March (Fig. 2). The only summer survey sorted for pollock occurred in August.

The spring surveys, which spanned the years from 1981 to 1983, did not detect any Stage I pollock eggs. The fall surveys (1981-97) observed many Stage I pollock eggs but only off southwest Nova Scotia from 1987-97. Very few Stage II pollock eggs were found. As with the previous stage, the majority occurred in the fall beginning in 1986 off southwest Nova Scotia. A few spring occurrences of Stage II pollock eggs were seen around the entrance to the Bay of Fundy in early March of 1981. Spring occurrences of Stage III pollock eggs in the same area of the Bay of Fundy were more abundant and included southwest Nova Scotia in the years 1981, 1982 and 1984. Again, the majority of Stage III pollock eggs were observed in the fall off southwest Nova Scotia. Fewer Stage IV pollock eggs were found. These eggs occurred in the fall and were located off southwest Nova Scotia. Larvae 1-7 mm long occurred both in the inner Bay of Fundy and off southwest Nova Scotia in both the spring and fall during the years 1979 and 1981-84. Larvae >7 mm were detected in a large number of samples in the same areas but only in the spring of 1979 and 1983.

LHP-Georges Bank (Fig. 8.2.1-8.2.6)

The Georges Bank surveys also had a narrow temporal window focusing on the period between October 26 and November 30 from 1987-95. Surveys from 1992-95 had later start and end dates within this time period (Fig. 3). The spatial extent for the samples was limited to the north end of Georges and occasionally Browns Bank.

Stages I, II and III were found on Georges and Browns Bank. More sightings occurred for the years 1992-95 when the surveys were conducted a few weeks later than in previous years. Stage II eggs were less frequently observed than either Stage I or III. As with the BoF surveys, Stage IV eggs had by far the fewest occurrences of all the egg stages. Of the larvae, only those 1-7 mm long were observed and these were also more prevalent in the later years of the program.

FEP (Fig. 8.3.1-8.3.6)

This program is characterized by a longer sampling period in a given year, February 5-June 21, but for only 3 yr, 1983-85 (Fig. 5). The maximum area sampled extends from the south coast of Nova Scotia to the tip of Georges Bank and from the Lurcher Shoals to La Have Bank.

From 1983-84, Stage I eggs were absent in most locations except for a few occurrences in May and June on Browns Bank. In 1985, these eggs were detected at numerous sites in February throughout the southwest Nova Scotia and Browns Bank area. By March the spatial extent was limited to Georges and Browns Bank and in April some near shore occurrences, but from May through mid June eggs were restricted to increasingly fewer locations on Browns Bank. The majority of Stage II pollock egg occurrences were in February of 1984 and 1985 with locations common to Stage I. Stage III pollock eggs also occurred primarily in February, particularly in 1984 and 1985, and largely in the southwest Nova Scotia/Browns/Georges Bank area. A similar pattern was observed for Stage IV pollock eggs but with a fewer number of occurrences limited to the Browns Bank area.

The peak spatial extent for larvae was in February. Larvae 1-7 mm long were detected as late as June on Browns Bank. Based on the 1985 samples the trend was for these larvae to be found in the south-southwest Nova Scotia/Browns Bank

area in February followed by contracting occurrences on Browns Bank from March to June. Larvae >7 mm showed the same decline in spatial extent from February. Georges Bank samples did not detect any larvae >7mm.

SSIP (Fig. 8.4.1 to 8.4.6)

Data from the SSIP program exists for every year from 1976 to 1982 and spans the entire year and the entire Scotian Shelf (Fig. 4). The spatial and temporal coverage varied annually making it difficult to discern patterns in distribution. Very few Stage I pollock eggs were observed and these were found scattered over the Scotian Shelf from November to February during 1980 and 1981. The occurrence of Stage II pollock eggs was marginally more frequent. They were found primarily over Emerald Bank from November to January, although some occurrences were reported from the eastern and western Scotian Shelf in January and February of 1981. The pattern for Stage III eggs was somewhat similar. Although the occurrence of Stage IV pollock eggs was relatively low, they appeared to be centrally located in the Emerald/Western/Sable Island Bank area. The larvae were also found mainly over the central Scotian Shelf. Unlike the smaller larvae, those >7mm were not detected in November.

SUMMARY

The relatively low occurrence of early life stages of pollock, coupled with fluctuations in occurrence from year to year make patterns difficult to detect. The complications were smoothed over through the aggregation of data from different ichthyoplankton monitoring programs that covered a variety of locations and time periods. This compositing filled in spatial and temporal holes and consequently helped to define the regional and temporal bounds of pollock spawning stocks in the Bay of Fundy and Scotian Shelf. The composite data support the existence of a protracted spawning during the fall and winter months with a peak during November/December. Neilson and Perley (1996) locate the peak during December/January. The timing of spawning appeared to vary spatially, yet spatial differences in the distribution of early life stages were generally not seen.

ACKNOWLEDGMENTS

This document evolved over a long period of time and benefited from the input of many individuals. Stephanie Warrington, aided by Peter Perley in the development of the database queries, began the initial exploration of the data. Mike Power and Jack Fife provided some historical information on the operations of the Larval Herring Program. Peter Perley reviewed a draft of this manuscript. And finally, Jerry Black contributed his expertise regarding the use of the ACON mapping software.

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Table 1. A brief overview of the temporal and spatial coverage of the ichthyoplankton surveys summarized in this report.

Program	Temporal Coverage	Spatial Range	Spatial Coverage	NAFO Area
LHP Bay of Fundy	1975-1984: 1 spring and 1 fall survey/year 1977-1980: added 1 summer survey/year 1985-1997: 1 fall survey/year	Lat: 41°15'-45°58.38' N Long: 61°24.38'-68°07' W	Bay of Fundy Area off south-west Nova Scotia	Mostly 4X
LHP Georges Bank	1987-1995 1 fall survey/year	Lat: 40°15'-45°46' N Long: 62°29.92'-68°59.43' W	Georges Bank	5Z 4X
FEP	1983-1985 Monthly, Feb.-Jun. (5 surveys/year)	Lat: 41°28.23'-45°10.62' N Long: 64°18.51'-67°21.09' W	Area off south-west Nova Scotia	4X only
SSIP	1976-1982 Spring, summer, fall, and winter surveys (4-7 surveys/year) 1976: 1 summer survey only	Lat: 40°28.05'-47°10'00" N Long: 56°41.26'-65°30'30" W	Scotian Shelf, not including the Bay of Fundy	4V 4W 4X

Table 2. The survey dates and stations for all ichthyoplankton surveys conducted by the Larval Herring Program in the Bay of Fundy (survey type 3). Only the most recent surveys (e.g. N865) do not appear in the distribution plots. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Survey	Year	Start date (dd mm)	End date (dd mm)	Total sets	Total stations	Standard stations	Special stations						
							A[a]	R[b]	I[c]	T[d]	P[e]	N[f]	H[g]
P151	1975	02 Apr	11 Apr	129	129	113			16				
P193	1978	15 Mar	01 Apr	113	113	113							
P217	1979	23 Mar	29 Mar	114	113	113							
P227	1979	08 Aug	16 Aug	162	143	143							
P250	1981	03 Mar	12 Mar	152	152	144			8				
P263	1981	10 Nov	22 Nov	151	151	143			8				
P268	1982	05 Mar	18 Mar	150	150	142			8				
P280	1982	27 Oct	07 Nov	170	160	143	3		14				
P287	1983	15 Mar	27 Mar	159	158	142			16				
P298	1983	01 Nov	12 Nov	156	156	146			10				
P301	1984	28 Feb	13 Mar	121	110	105			5				
P315	1984	02 Nov	14 Nov	179	173	152	9		12				
P329[h]	1985	22 Oct	13 Nov	242	162	146			16				
P344	1986	28 Oct	12 Nov	188	164	154			9		1		
P361	1987	21 Oct	11 Nov	188	163	154			9				
P377	1988	25 Oct	09 Nov	206	206	145		52	9				
P391	1989	25 Oct	08 Nov	226	225	150		50	9		11		5
P408	1990	25 Oct	06 Nov	158	154	132		18	4				
P422	1991	02 Nov	14 Nov	142	134	112			3		15		4
P437	1992	29 Oct	11 Nov	144	125	119			6				
P451	1993	24 Oct	04 Nov	124	124	115			6		3		
N211	1994	02 Nov	15 Nov	166	162	130			7	2	7	16	
N232	1995	01 Nov	13 Nov	125	100	92			2		4	2	
N252	1996	02 Nov	15 Nov	156	145	106			7	2	9	18	3
N765	1997	29 Oct	07 Nov	103	102	98			1	1	1	1	
N865	1998	28 Oct	09 Nov	135	128	113			2		5	5	3

[a] Special case additions (e.g. P280 - Canada/USA larval study; P329 – comparative tows with Lady Hammond)
[b] Random stations. [c] ICNAF stations. [d] Standard Halifax transect stations.
[e, f, g] Prince, Needler and Hammond stations, respectively. Named after first vessel to sample the station.
[h] Usual survey extended for intensive sampling of southwest Nova Scotia area (4 passes) during this survey. Many stations sampled >= 2 times (Stephenson and Power 1989).

Table 3. The survey dates for all ichthyoplankton surveys appearing in the distribution plots and conducted by the Larval Herring Program on Georges Bank. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Survey	Year	Start date (dd mm)	End date (dd mm)	Total sets	Total stations	Standard stations	Special stations					
							A[a]	T[b]	N[c]	H[d]	F[e]	E[f]
H181	1987	24 Oct	09 Nov	140	48	48						
H195	1988	29 Oct	09 Nov	87	80	70	10					
H207	1989	26 Oct	08 Nov	129	101	95				6		
H222	1990	28 Oct	09 Nov	112	102	81					21	
H235	1991	02 Nov	10 Nov	97	93	74					19	
Z049	1992	24 Nov	30 Nov	86	86	86						
N195	1993	14 Nov	24 Nov	72	71	71						
N213	1994	16 Nov	28 Nov	106	104	99		4				1
N233	1995	17 Nov	28 Nov	113	110	101		5	4			

[a] Additional stations. [b] Standard Halifax transect stations. [c] Needler stations. [d] Hammond stations. [e] Fishing trawl stations with hydro data only. [f] Emerald Basin stations with hydro data only.

Table 4. Larval Herring Program ichthyoplankton surveys not appearing in the distribution plots.. The number of stations sometimes exceeds the number of standard stations because of additional special sampling needs.

Survey	Year	Start date (dd mm)	End date (dd mm)	Total sets	Total stations	Standard stations	Comments
P160	1975	05 Nov	13 Nov	100	91	87	Not known if sorted for pollock.
P163	1976	24 Mar	31 Mar	131	131	114	Not known if sorted for pollock.
P175	1976	10 Nov	17 Nov	124	116	110	Not known if sorted for pollock.
P180	1977	22 Mar	30 Mar	97	96	89	Not known if sorted for pollock.
P186	1977	09 Aug	16 Aug	132	132	115	Not known if sorted for pollock.
P190	1977	18 Oct	25 Oct	128	128	115	Not known if sorted for pollock.
P202	1978	15 Aug	20 Aug	115	115	115	Not known if sorted for pollock.
P207	1978	01 Nov	07 Nov	115	115	115	Not known if sorted for pollock.
P226	1979	25 Jul	31 Jul	106	106	106	Not known if sorted for pollock.
P228	1979	20 Aug	26 Aug	116	116	116	Not known if sorted for pollock.
P232	1979	31 Oct	06 Nov	115	115	115	Not known if sorted for pollock.
P234	1980	04 Mar	13 Mar	111	111	111	Not known if sorted for pollock.
P243	1980	12 Aug	20 Aug	160	160	144	Not known if sorted for pollock.
P246	1980	03 Nov	12 Nov	131	131	122	Not known if sorted for pollock.
V710	1997	13 May	25 May	38	38	38	A Bras d'Or Lakes survey.
V778	1997	20 Jun	26 Jun	53	53	53	A Bras d'Or Lakes survey.

Table 5. Ichthyoplankton surveys that are considered part of the Scotian Shelf Ichthyoplankton Program data set but were not included in the present analyses. Information in this table obtained from Anon. (1989).

Survey	Year	# Oblique Bongo Tows	Comments
AP01	1980	79	• a joint Canada-USSR survey • sampling part of a patch study restricted to Emerald Bank
AP02	1980	27	• a joint Canada-USSR survey • sampling part of a patch study restricted to Emerald Bank
HO41	1980	229	• a joint Canada-USSR survey • sampling primarily a patch study on Emerald and Western Banks
AR01	1980	80	• a silver hake survey
AR02	1980	38	• a silver hake survey

Table 6. The survey dates for ichthyoplankton surveys appearing in the distribution plots and conducted by the Scotian Shelf Ichthyoplankton Program.

Survey	Year	Start date (dd mm)	End date (dd mm)	Total sets	Total stations	Standard stations
P170	1976	12 Aug	24 Aug	76	76	76
CC01	1977	15 Feb	26 Mar	176	136	136
P182	1977	30 Apr	19 May	129	129	129
CL01	1977	8 Aug	2 Sep	159	159	159
FT01	1977	21 Sep	19 Oct	161	149	149
CC02	1978	17 May	14 Jul	395	199	199
VY01	1978	06 Aug	25 Aug	147	147	147
H005	1978	09 Aug	16 Aug	53	53	53
H006	1978	20 Aug	01 Sep	95	95	95
VY02	1978	29 Aug	15 Sep	149	148	148
H007	1978	06 Sep	08 Sep	20	20	20
H011	1979	23 Jan	02 Feb	37	37	37
H015	1979	02 Apr	25 Apr	124	124	124
H018	1979	14 May	31 May	78	78	78
VN01	1979	04 Aug	19 Aug	126	126	126
VN02	1979	24 Aug	10 Sep	125	125	125
H025	1979	24 Sep	12 Oct	91	91	91
H028	1979	13 Nov	05 Dec	118	118	118
H032	1980	05 Feb	28 Feb	95	95	95
H035	1980	07 May	29 May	138	138	138
H036	1980	03 Jun	26 Jun	153	153	153
BR02	1980	11 Jul	04 Aug	91	91	91
LE01	1980	15 Aug	31 Aug	130	130	130
LE02	1980	4 Sep	22 Sep	126	125	125
AR03	1980	02 Oct	29 Oct	122	122	122
H045	1980	20 Nov	14 Dec	100	100	100
H047	1981	22 Jan	19 Feb	156	156	156
H050	1981	24 Mar	14 Apr	109	109	109
EK01	1981	26 Aug	12 Sep	79	79	79
EK02	1981	16 Sep	09 Oct	99	99	99
H069	1982	07 Jan	28 Jan	46	46	46
P271	1982	07 May	20 May	35	35	35
P276	1982	13 Jul	05 Aug	97	97	97
EK04	1982	23 Sep	12 Oct	92	92	92

Table 7. The survey dates for ichthyoplankton surveys appearing in the distribution plots and conducted by the Fisheries Ecology Program.

Survey	Year	Start date (dd mm)	End date (dd mm)	Total sets	Total stations	Standard stations
H091	1983	09 Feb	17 Feb	53	53	53
H093	1983	06 Mar	16 Mar	50	50	50
P288	1983	07 Apr	20 Apr	49	49	49
H097	1983	04 May	13 May	78	78	78
H099	1983	04 Jun	12 Jun	82	81	81
H112	1984	08 Feb	22 Feb	74	73	73
H114	1984	22 Mar	29 Mar	54	54	54
H116	1984	17 Apr	25 Apr	62	62	62
H118	1984	15 May	23 May	70	70	70
H120	1984	12 Jun	21 Jun	84	82	82
H130	1985	05 Feb	21 Feb	89	84	84
H132	1985	14 Mar	27 Mar	66	48	48
H133	1985	03 Apr	17 Apr	109	88	88
H135	1985	07 May	16 May	73	57	57
H137	1985	04 Jun	13 Jun	79	61	61

Table 8. Gear type and the number of samples collected and processed as part of the Larval Herring Program between 1975 and 1995 in the Bay of Fundy. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates a port sample.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
0.5m NET - Vertical			
64µm	466	0	0
253µm	529	120	22.68
BONGO (61cm) - ICNAF Double Oblique			
P505µm	1	0	0
S505µm	1	0	0
BONGO (61cm) - Surface			
P505µm	77	0	0
S505µm	77	0	0
BONGO (61cm) – Saw Tooth			
P333µm	91	83	91.21
P505µm	6061	4631	76.41
S333µm	1547	353	22.82
S505µm	4468	928	20.77
NEUSTON – Surface			
1179µm	468	3	0.64
ISAACS-KID – Saw Tooth			
S505µm	1	0	0
Total	13787	6118	44.38

Table 9. Gear type and the number of samples collected and processed as part of the Larval Herring Program between 1987 and 1995. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample. A fish processing code of 0 was considered to mean not processed.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
UNKNOWN (code 77) - Vertical			
53µm	145	115	79.31
BIONESS – Old Stepped Oblique			
333µm	169	131	77.51
BIONESS – Saw Tooth			
333µm	88	67	76.14
BONGO (20cm) – Saw Tooth			
P064µm	63	0	0
P333µm	2	0	0
S064µm	63	0	0
S333µm	2	0	0
BONGO (61cm) – ICNAF Double Oblique			
P505µm	25	22	88.0
S505µm	25	3	12.0
BONGO (61cm) – Saw Tooth			
P064µm	1	0	0
P333µm	726	215	29.61
P505µm	524	387	73.85
S064µm	1	0	0
S333µm	1134	270	23.81
S505µm	93	1	1.07
BONGO (61cm) – Saw Tooth Vertical Profile			
P333µm	6	0	0
S333µm	6	0	0
Total	3073	1211	39.41

Table 10. Gear type and the number of samples collected and processed as part of the Fisheries Ecology Program between 1983 and 1985. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample and MARMAP stands for Marine Resources, Monitoring, Assessment and Prediction.

Gear/Tow Type	Total tows	Number of tows processed for Fish and/or Fish Eggs	Proportion of Total Tows Processed (%)
1m NET – Vertical			
64µm	199	0	0
80µm	48	0	0
120µm	138	0	0
202µm	3	0	0
253µm	5	0	0
BONGO (61cm) - MARMAP Double Oblique			
S080µm	20	0	0
P165µm	189	0	0
S165µm	57	0	0
P333µm	1586	1442	90.92
S333µm	1698	787	46.35
BONGO (61cm) - Surface			
S165µm	6	0	0
P333µm	1043	1021	97.89
S333µm	1037	56	5.40
Total	6029	3306	54.83

Table 11. Gear type and the number of samples collected and processed as part of the Scotian Shelf Ichthyoplankton Program between 1976 and 1982. For Gear/Tow Type, the numbers indicate the mesh size used, S indicates a starboard sample, P indicates the port sample and MARMAP stands for Marine Resources, Monitoring, Assessment and Prediction.

Gear/Tow Type	Total tows	Number of tows processed for fish and/or fish eggs	Proportion of total tows processed (%)
1m NET – Surface			
471µm	618	610	98.71
BONGO (61cm) – MARMAP Double Oblique			
P333µm	2818	2392	84.88
S333µm	2321	388	16.72
S471µm	497	0	0
BONGO (61cm) – Old Stepped Oblique			
P333µm	151	0	0
P471µm	864	367	42.48
S333µm	151	151	100
S471µm	864	460	53.24
BONGO (61cm) – Surface			
P333µm	1950	1785	91.54
S333µm	1950	133	6.82
NEUSTON – Surface			
333µm	176	172	97.73
1179µm	3422	3368	98.42
ISAACS-KIDD - MARMAP Double Oblique			
471µm	117	115	98.29
ISAACS-KIDD - Old Stepped Oblique			
471µm	1616	1561	96.60
ISAACS-KIDD – New Stepped Oblique			
471µm	540	527	97.59
SAMEOTO BOX NEUSTON - Surface			
405µm	251	251	100
Total	18306	12280	67.08

Table 12. Definition of the developmental stages of fish eggs as defined by Markle and Frost (1985).

Egg Stage	Stage Definition
Stage I	from spawning until the visible formation of an embryonic axis about the mid gastrula
Stage II	from the end of stage I until the embryo is half way around the yolk sac, which corresponds approximately to the time of blastopore closure
Stage III	from the end of stage II until the tip of the tail reaches or could reach the snout
Stage IV	from the end of stage III until hatching

Table 13. Initial processing codes for fish eggs, larvae and juveniles.

Code	Description
1	Identified and counted all fish and all fish eggs.
2	Identified and counted all fish and selected fish eggs.
3	Identified and counted all fish and no fish eggs.
4	Identified and counted selected fish and all fish eggs.
5	Identified and counted selected fish and selected fish eggs.
6	Identified and counted selected fish and no fish eggs.
7	Identified and counted no fish and all fish eggs.
8	Identified and counted no fish and selected fish eggs.
9	Identified and counted no fish and no fish eggs.
10	Sample lost in transit.
11	Sample rotten.
12	Sample hit bottom (full of sediment), not sorted.
13	Sample damaged while sorting.
14	Sample not sorted at present.
15	Sample not representative (tampered with or spilled).
16	Sorting information not available.

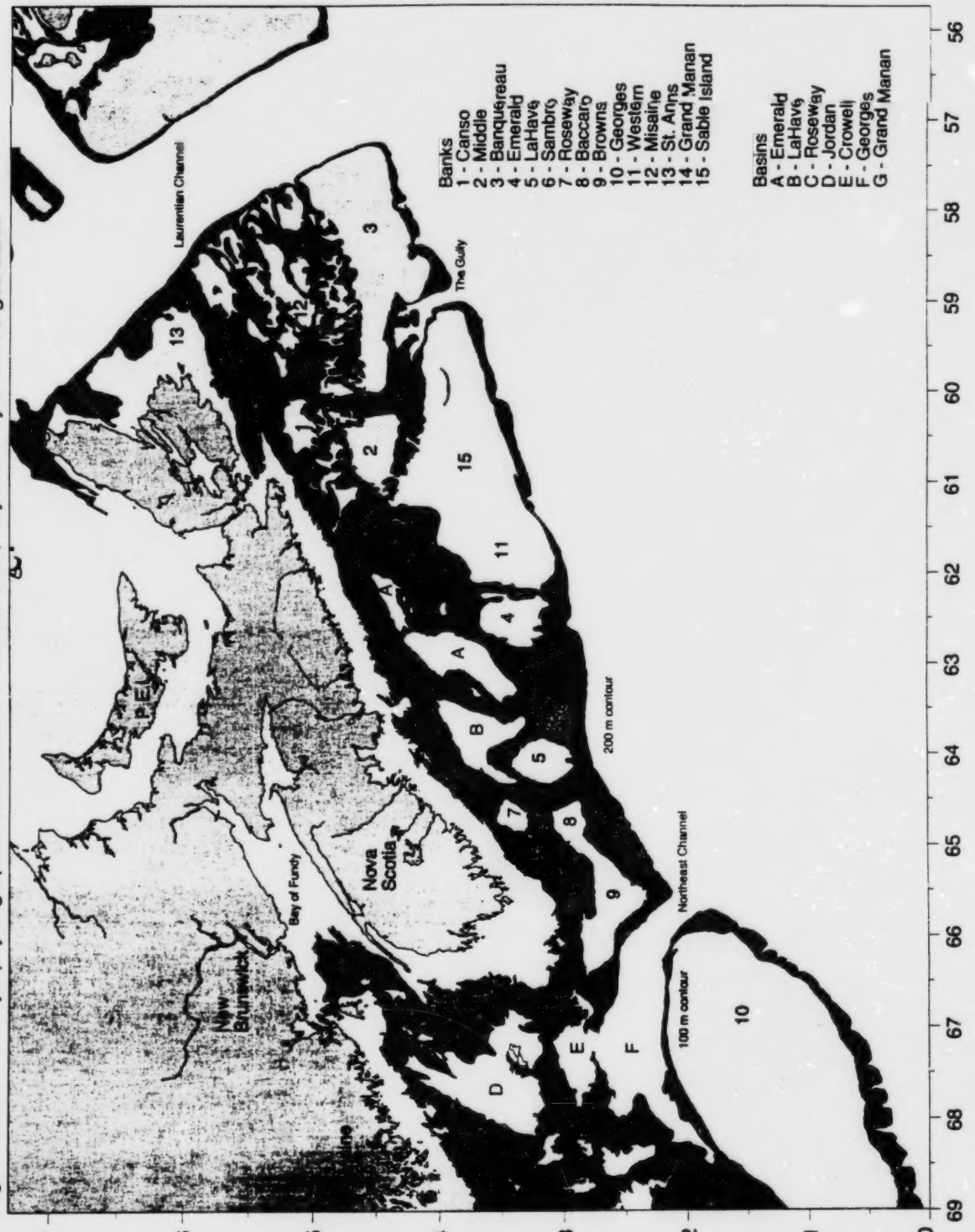


Fig. 1. Location of major physiographic features on the Scotian Shelf, Bay of Fundy and Georges Bank.

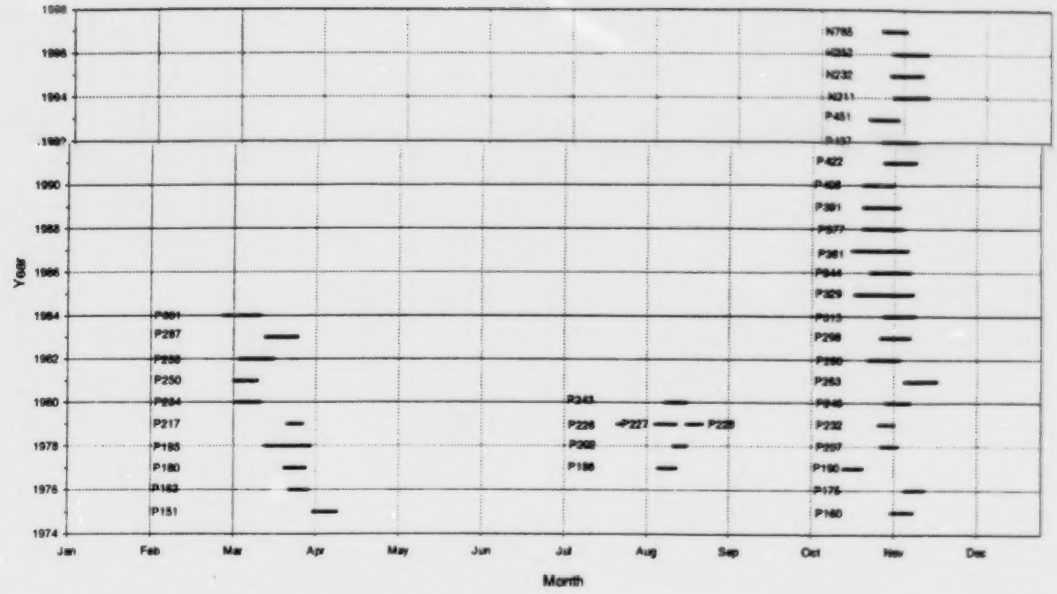


Fig. 2. Temporal coverage for LHP Bay of Fundy Cruises 1975 - 1997.

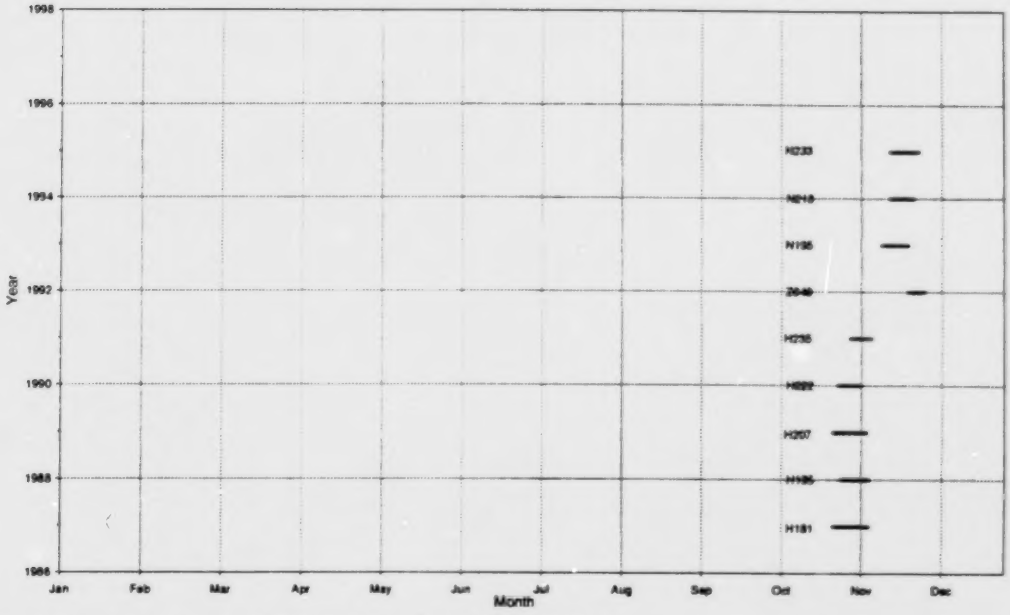


Fig. 3. Temporal coverage for LHP Georges Bank Cruises 1987 - 1995.

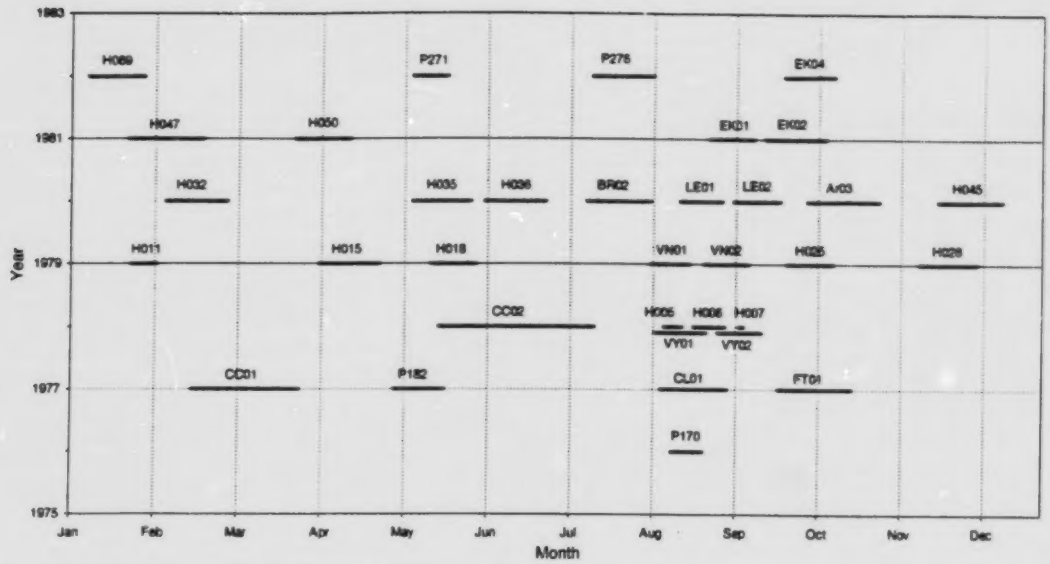


Fig. 4. Temporal coverage for SSIP Cruises 1976 - 1982.

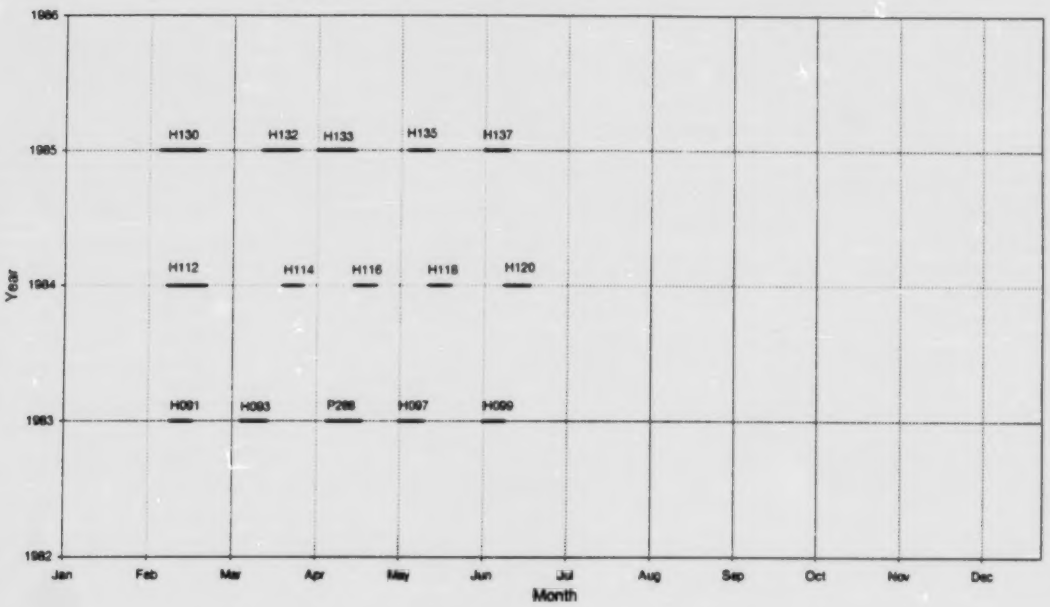


Fig. 5. Temporal coverage for FEP Cruises 1983 - 1985.

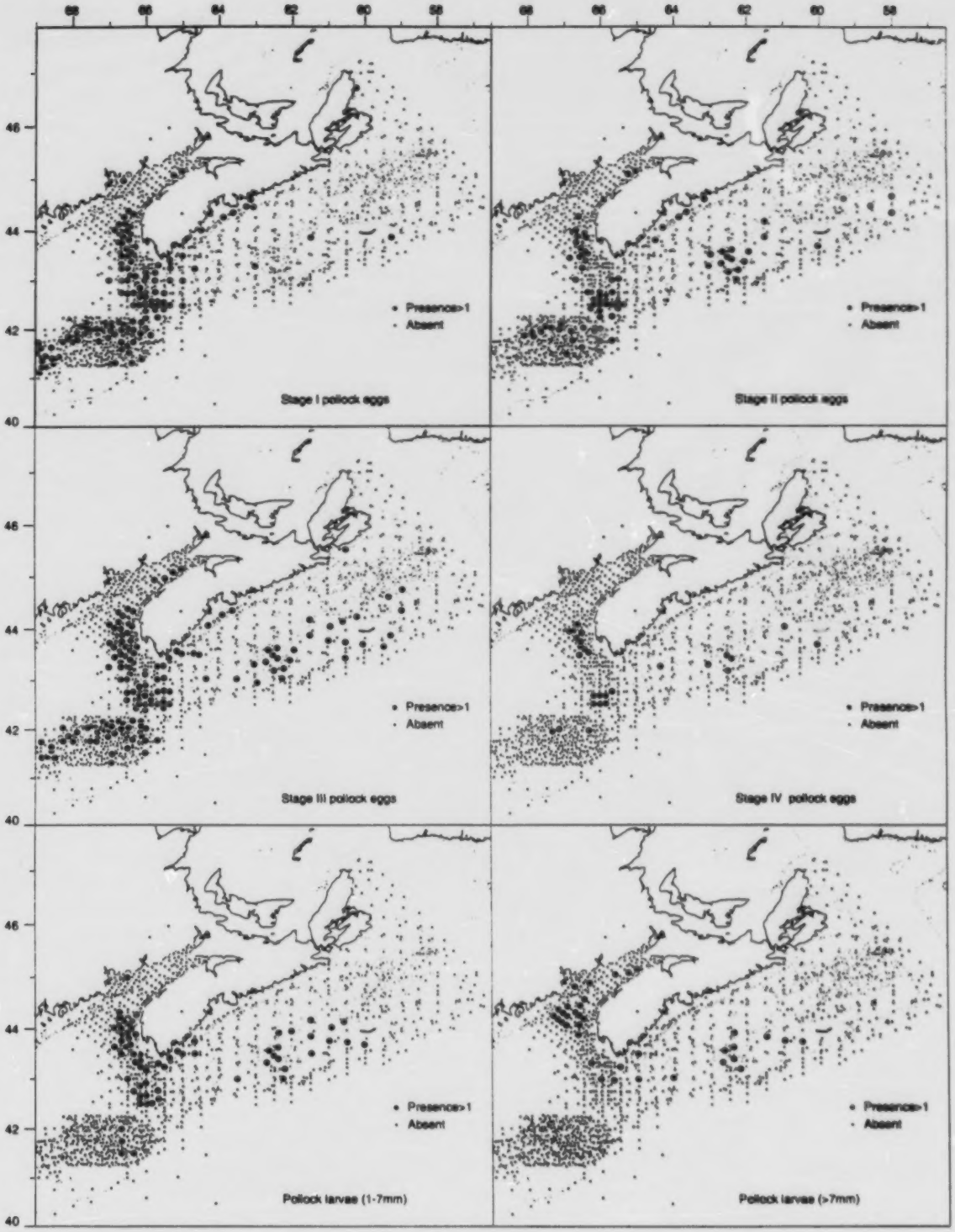


Fig. 6. Composite plot by life stage of all pollock ichthyoplankton data (1975-1997).

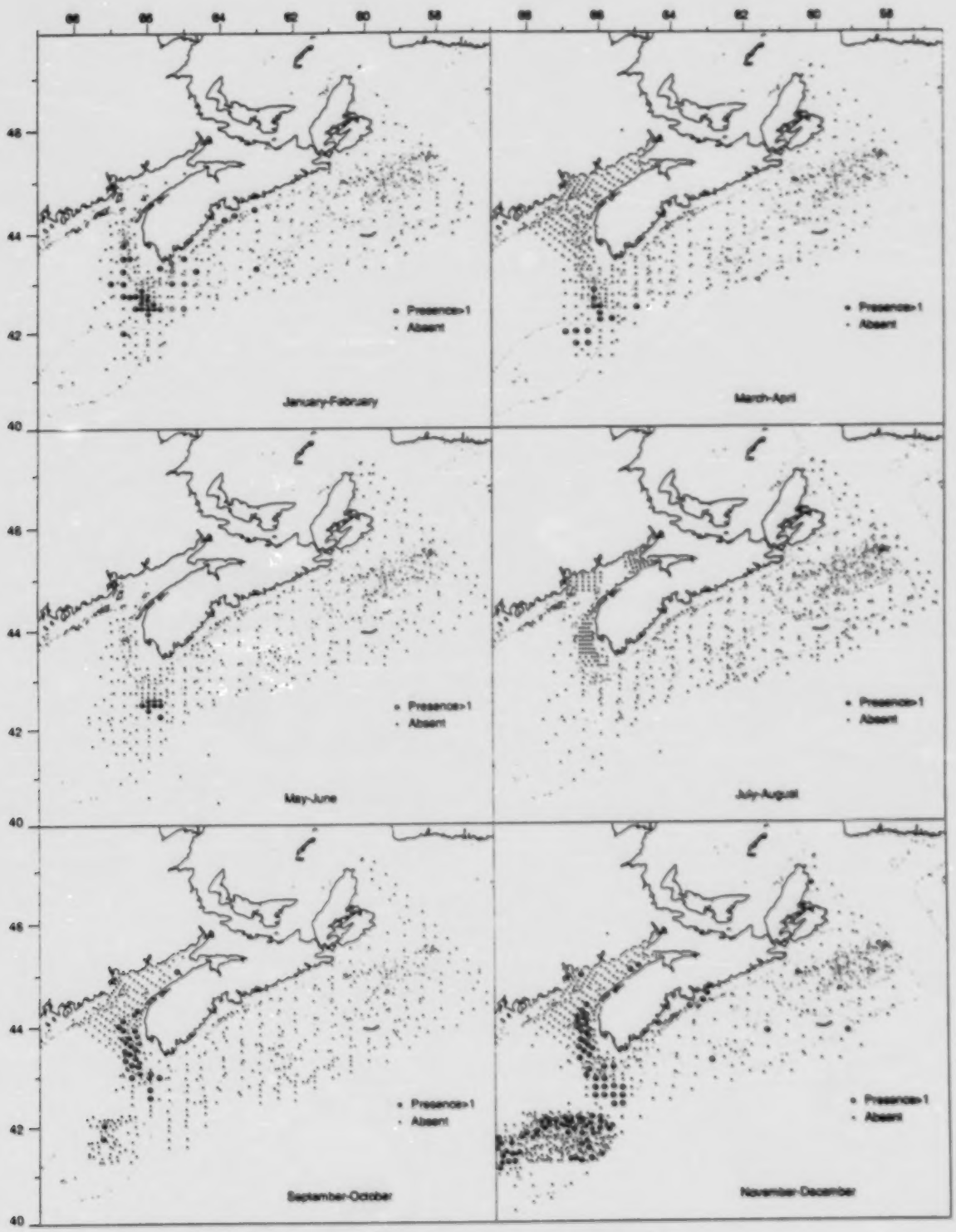


Fig. 7.1. Bimonthly composite plots of Stage I pollock eggs for stations sampled in all years and all programs (1975-1997).

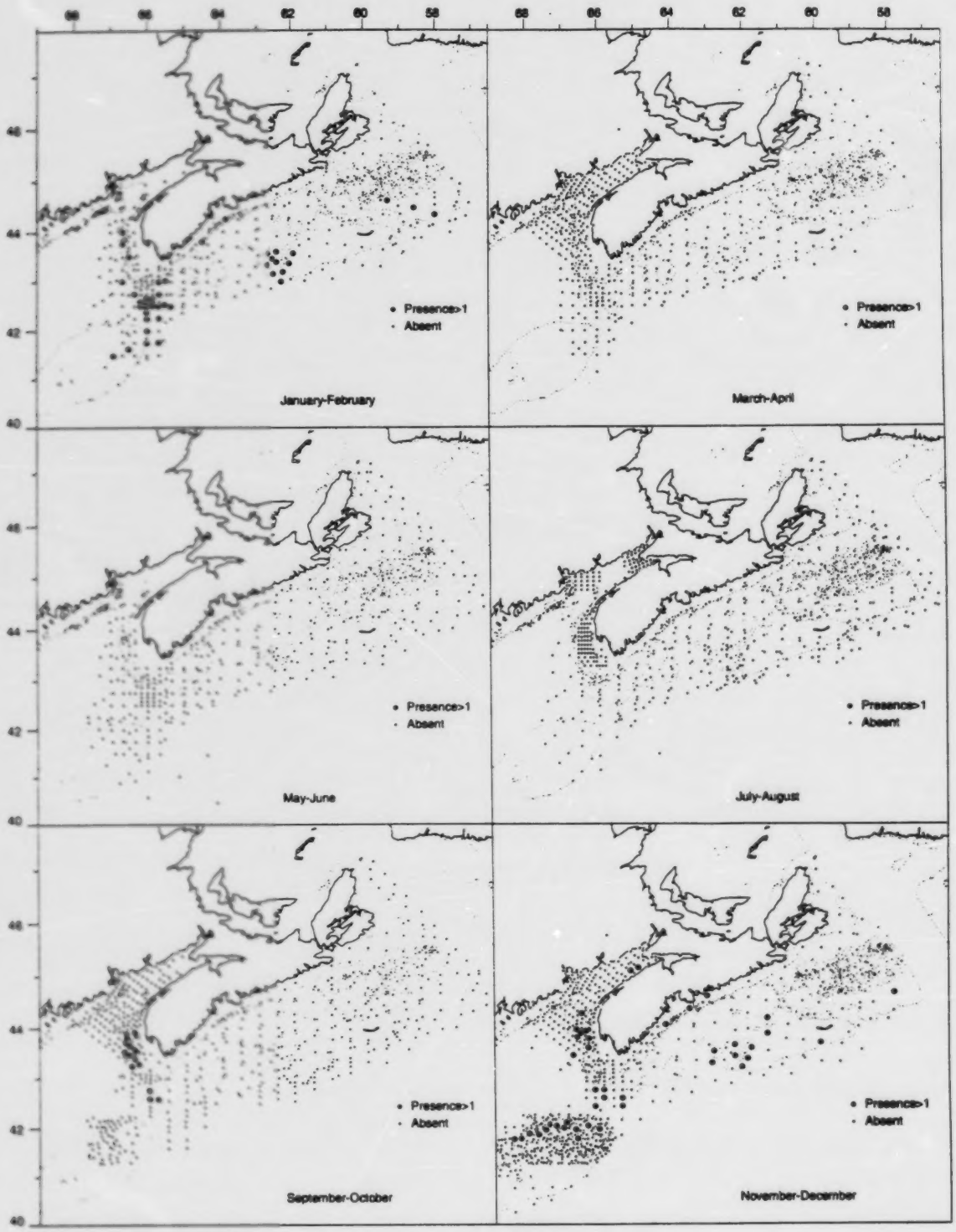


Fig. 7.2. Bimonthly composite plots of Stage II pollock eggs for stations sampled in all years and all programs (1975-1997).

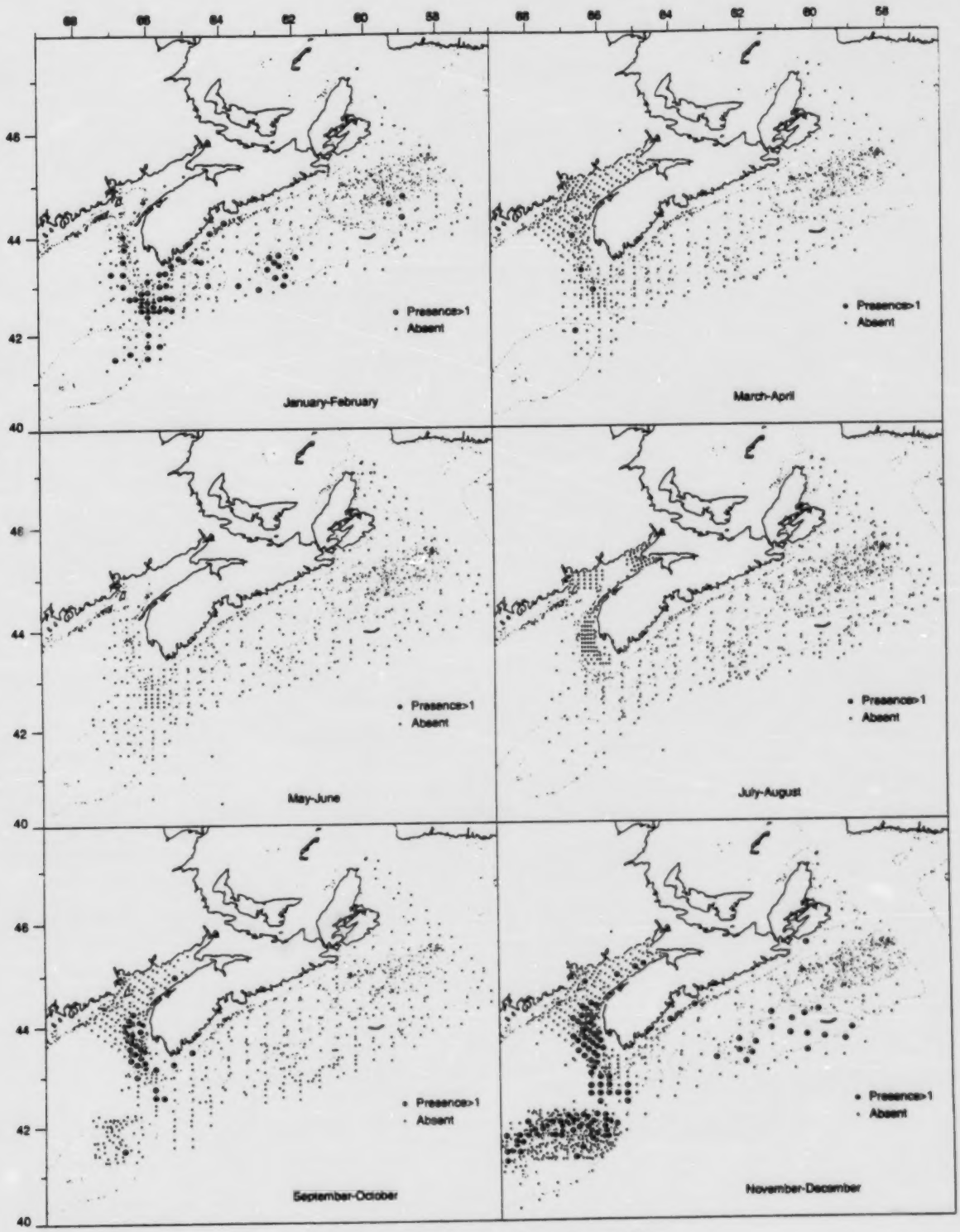


Fig. 7.3. Bimonthly composite plots of Stage III pollock eggs for stations sampled in all years and all programs (1975-1997).

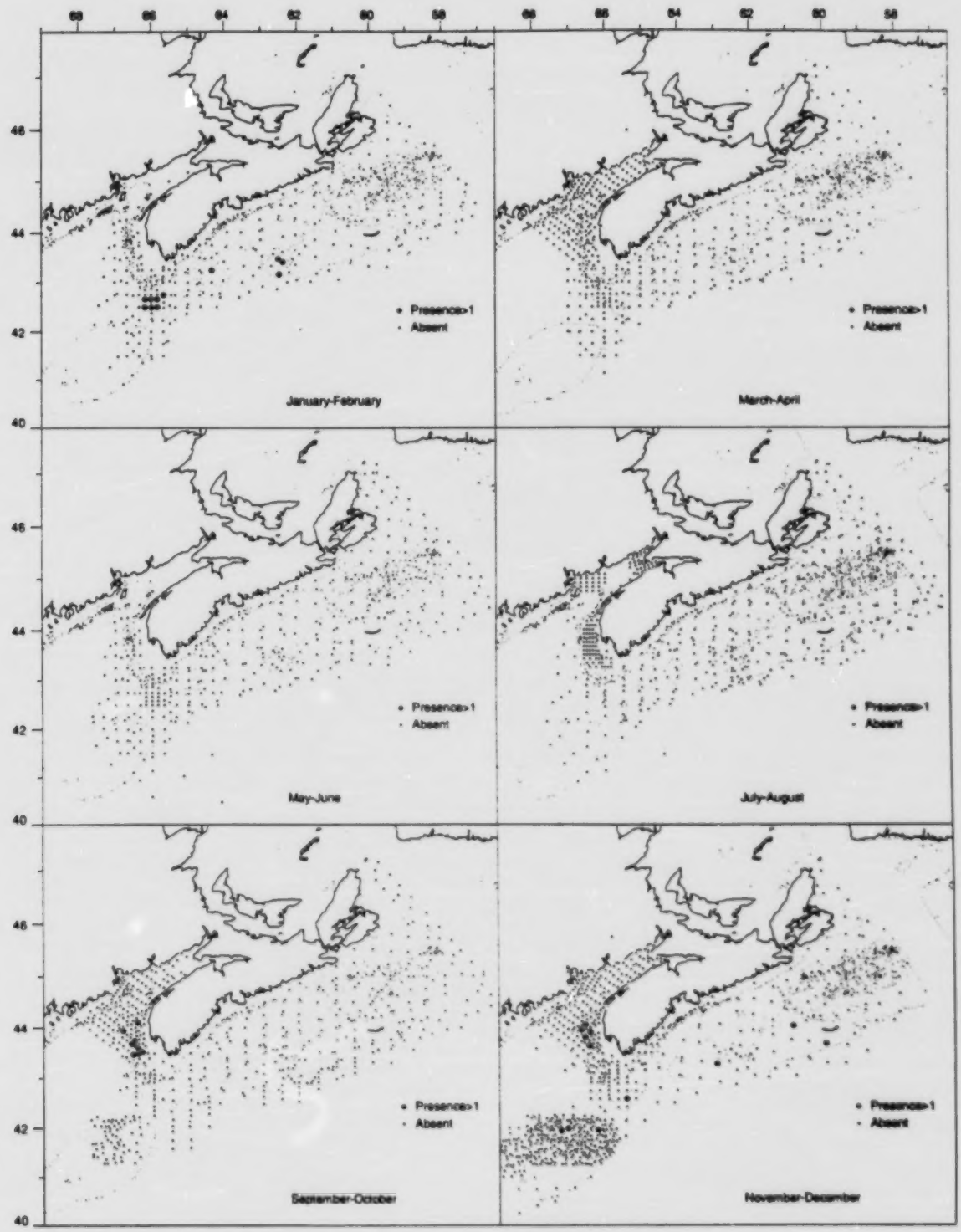


Fig. 7.4. Bimonthly composite plots of Stage IV pollock eggs for stations sampled in all years and all programs (1975-1997).

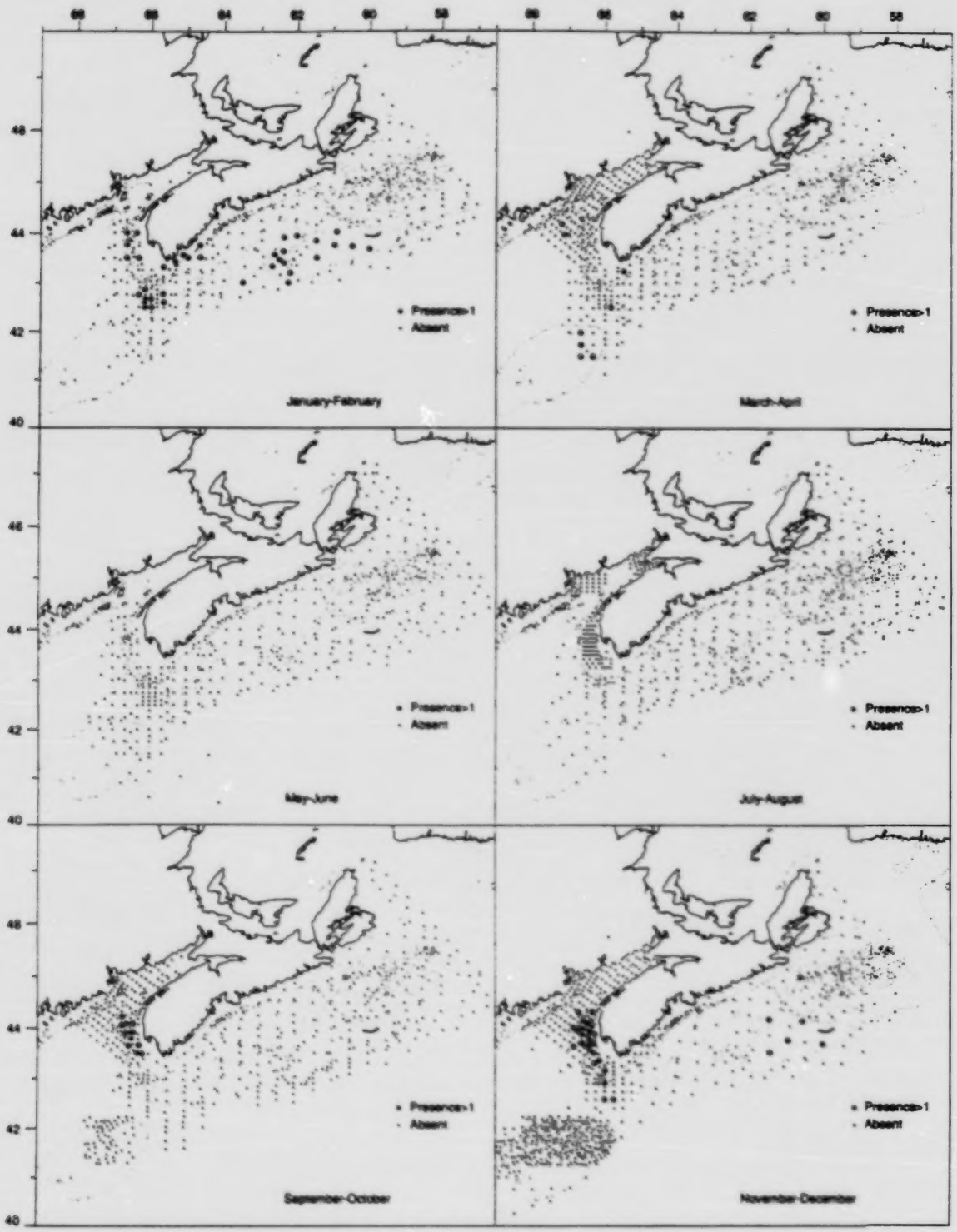


Fig. 7.5. Bimonthly composite plots of pollock larvae (1-7mm) for stations sampled in all years and all programs (1975-1997).

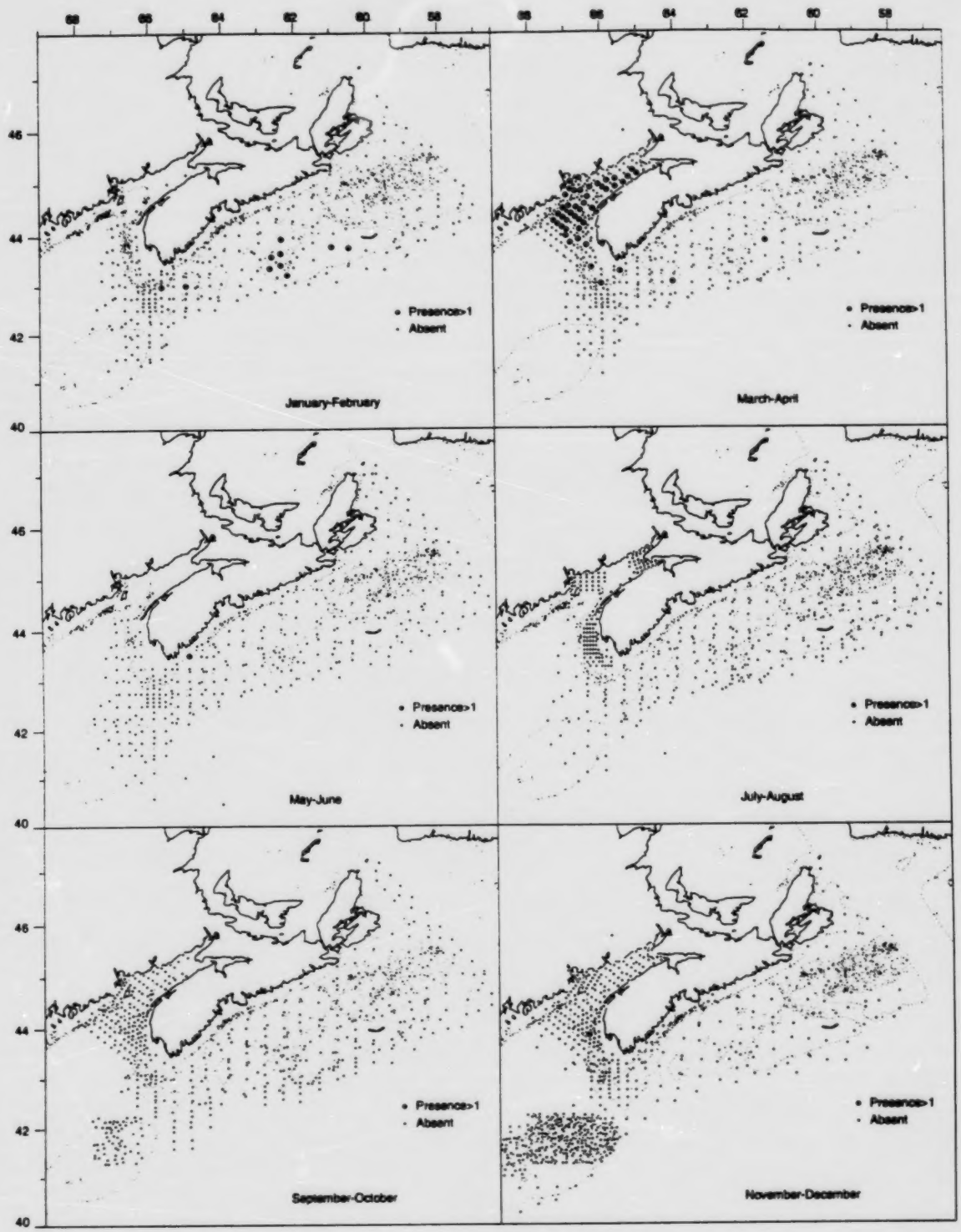


Fig. 7.6. Bimonthly composite plots of pollock larvae (>7mm) for stations sampled in all years and all programs (1975-1997).

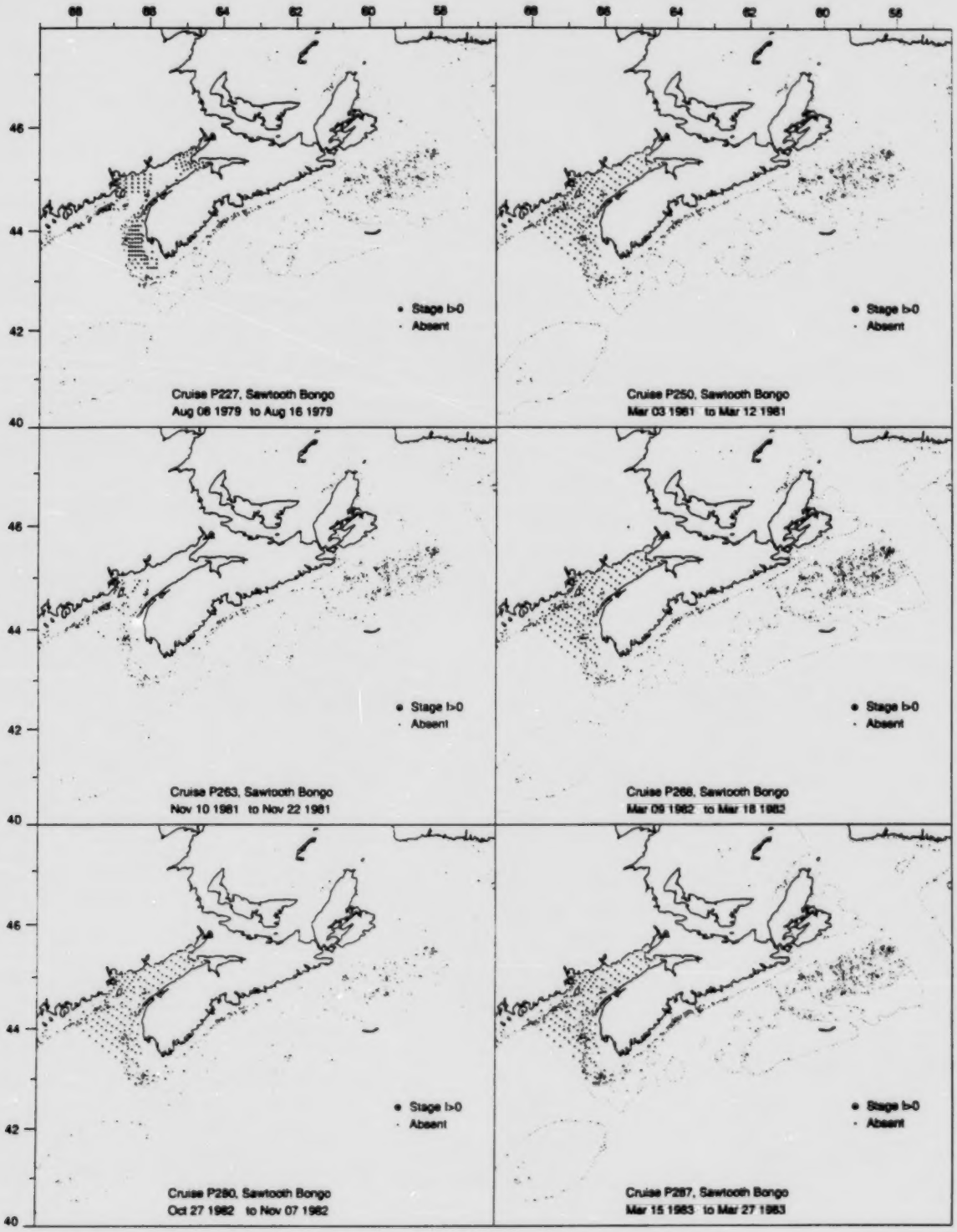


Fig. 8.1.1. Larval Herring Program-Bay of Fundy Cruises: Stage I pollock eggs.

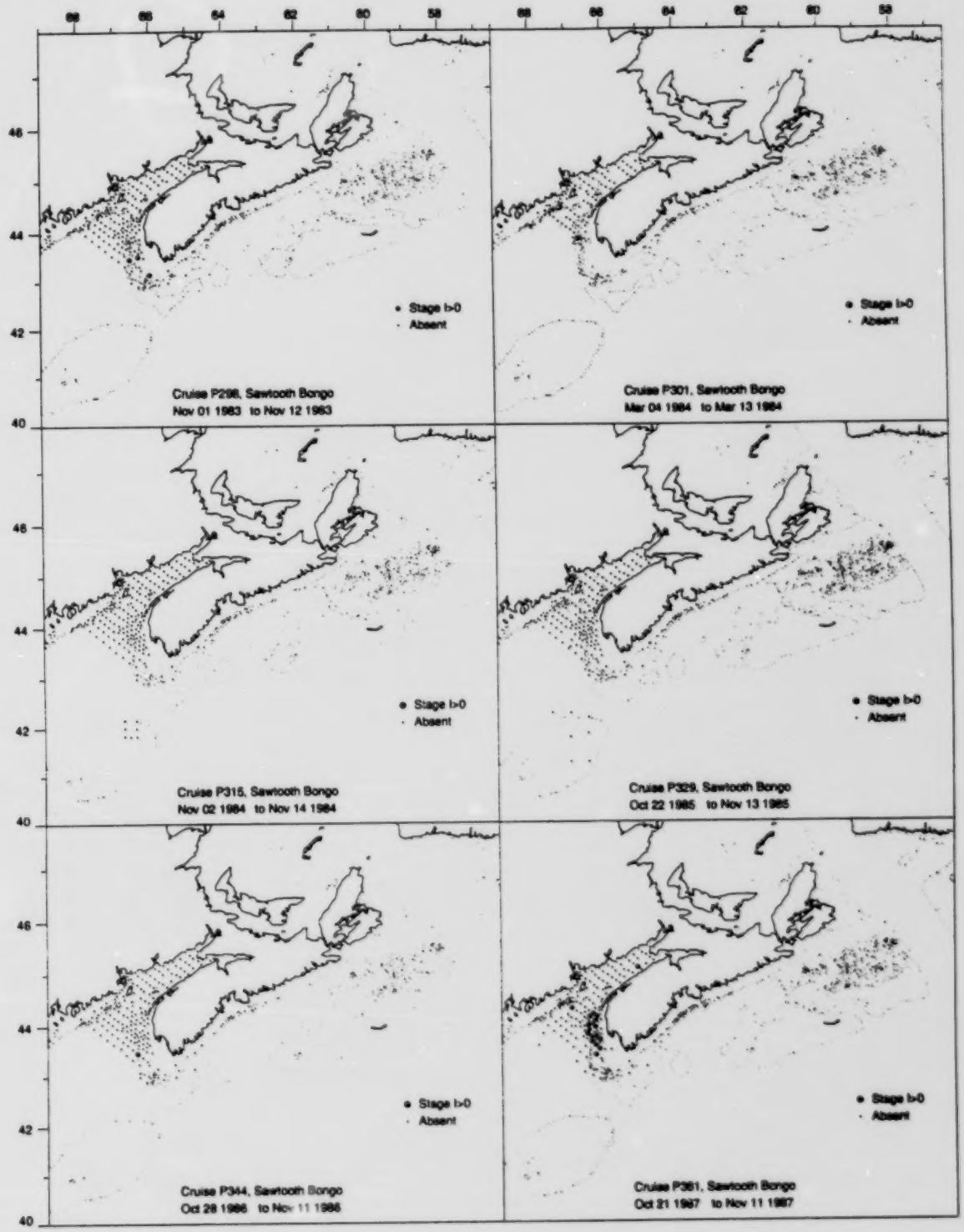

Stage I>0
Absent
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987

Fig. 8.1.1. (continued).

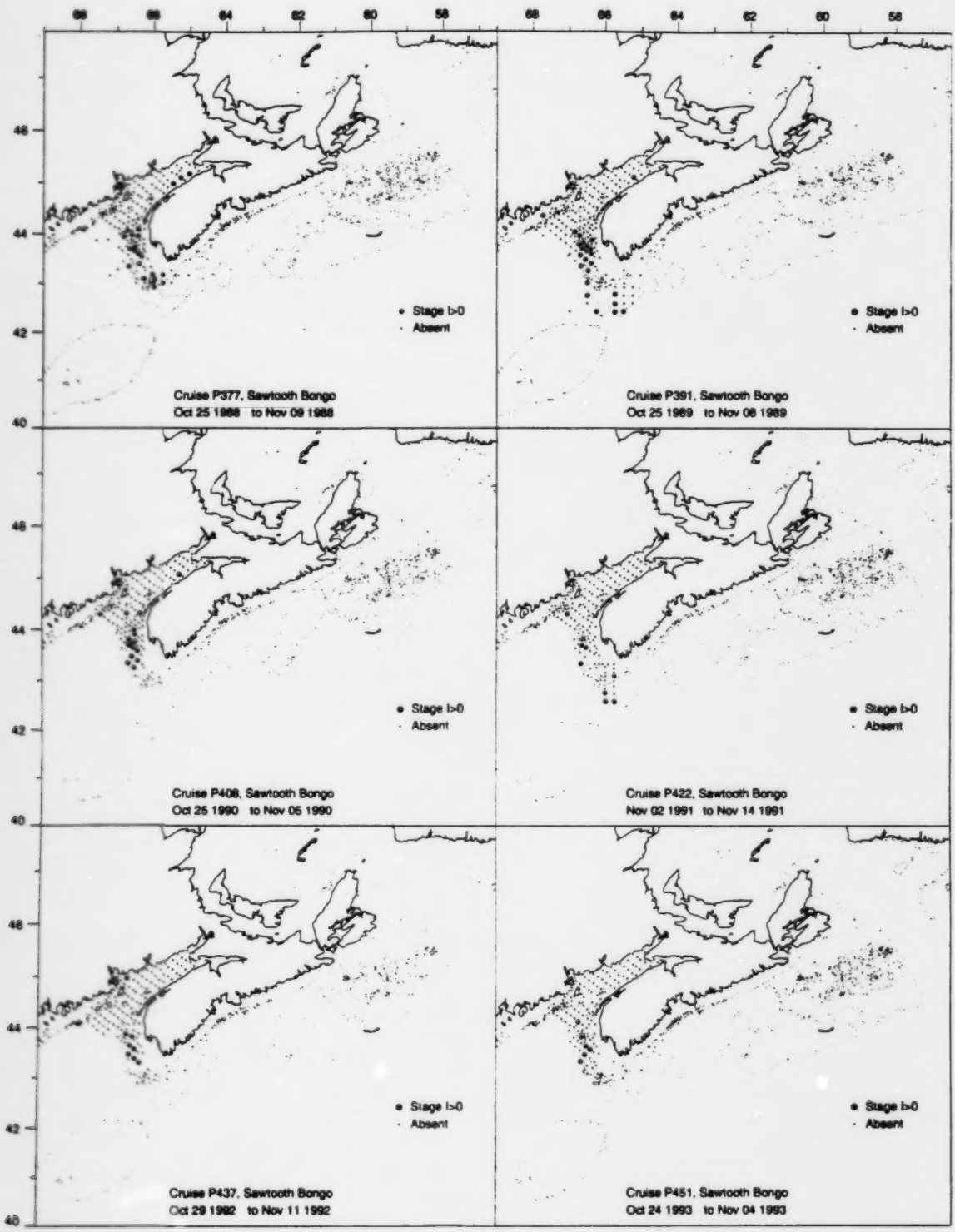

Stage I>0
Absent
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989
Cruise P408, Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993

Fig. 8.1.1. (continued).

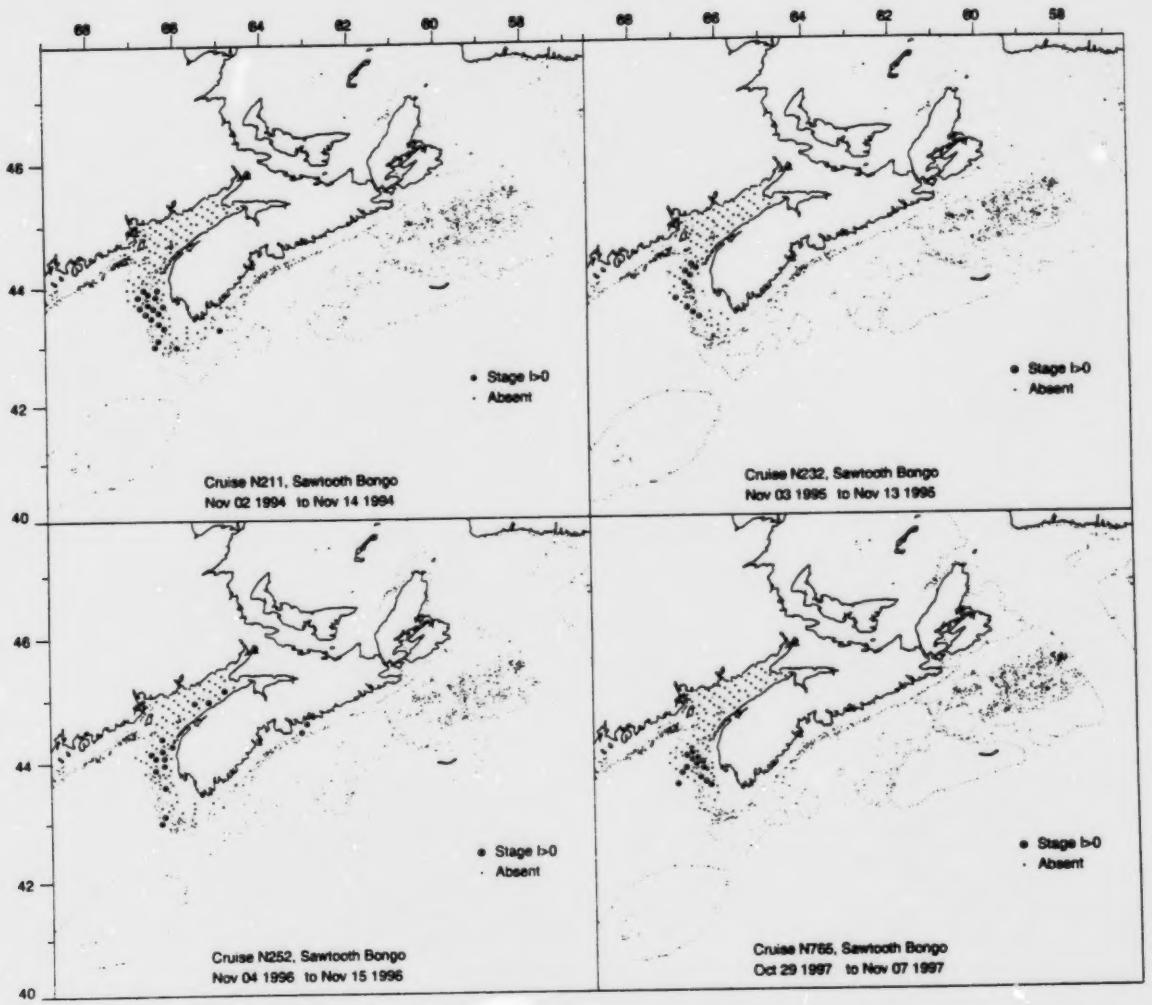


Fig. 8.1.1. (continued).

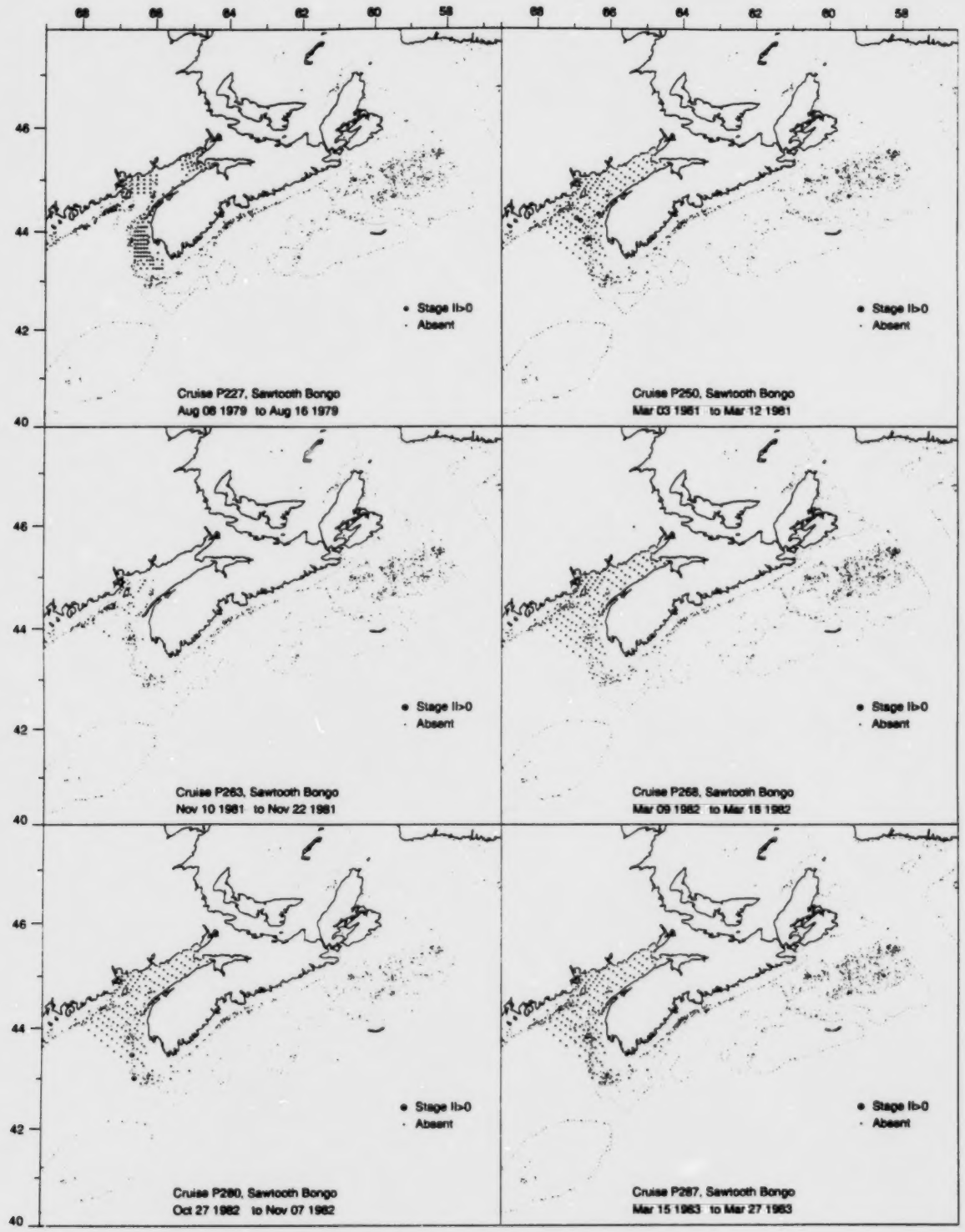


Fig. 8.1.2. Larval Herring Program-Bay of Fundy Cruises: Stage II pollock eggs.

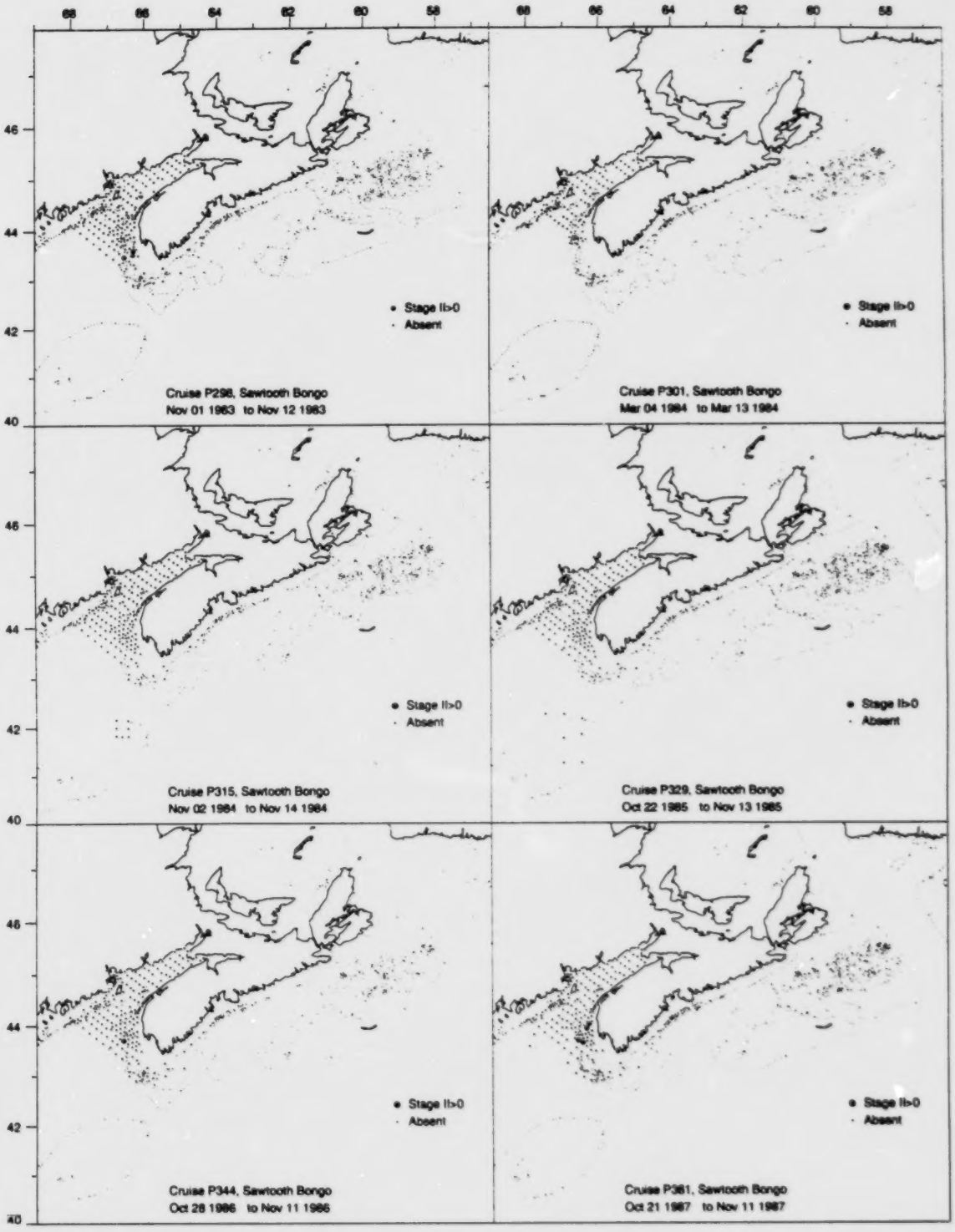
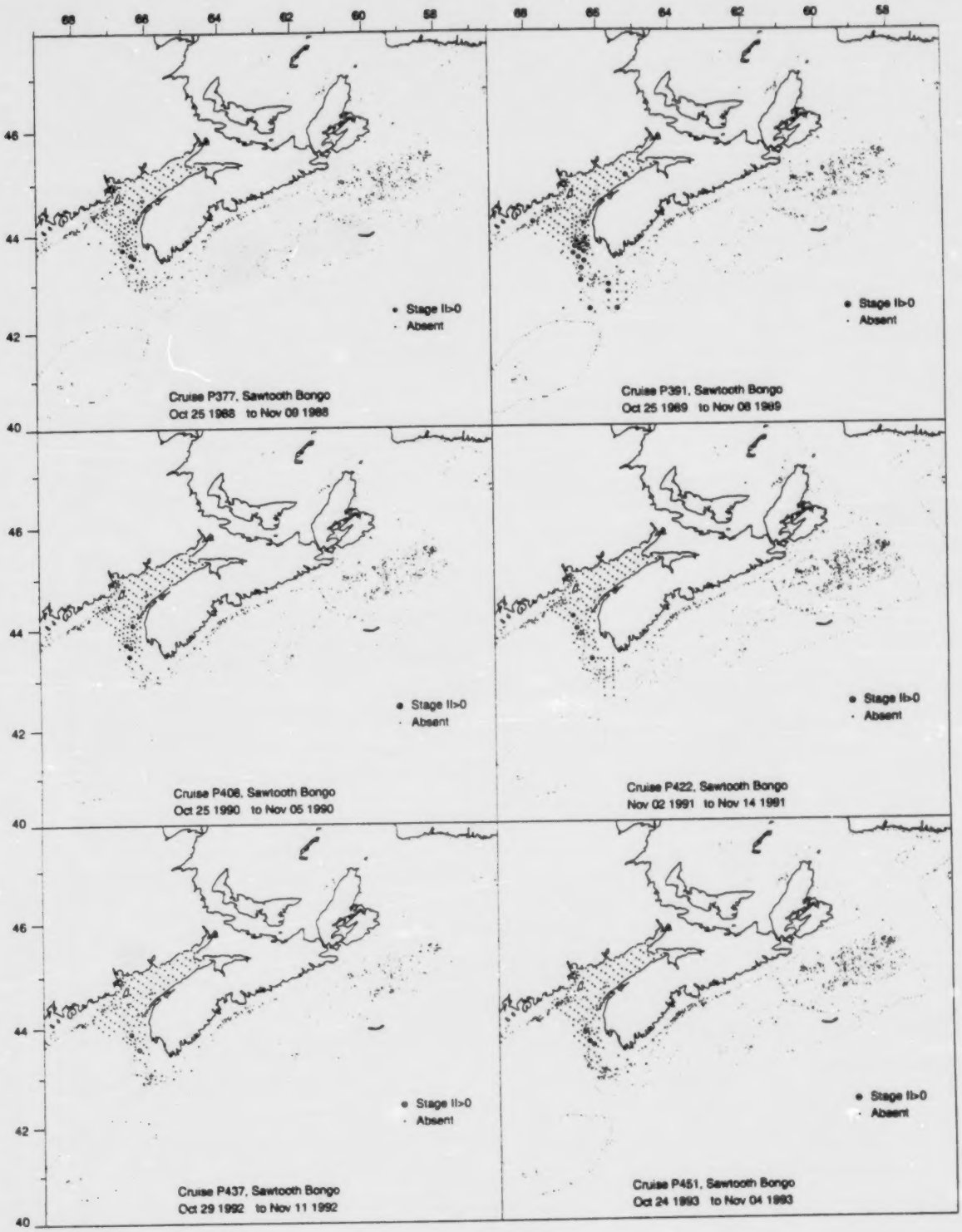


Fig. 8.1.2. (continued).



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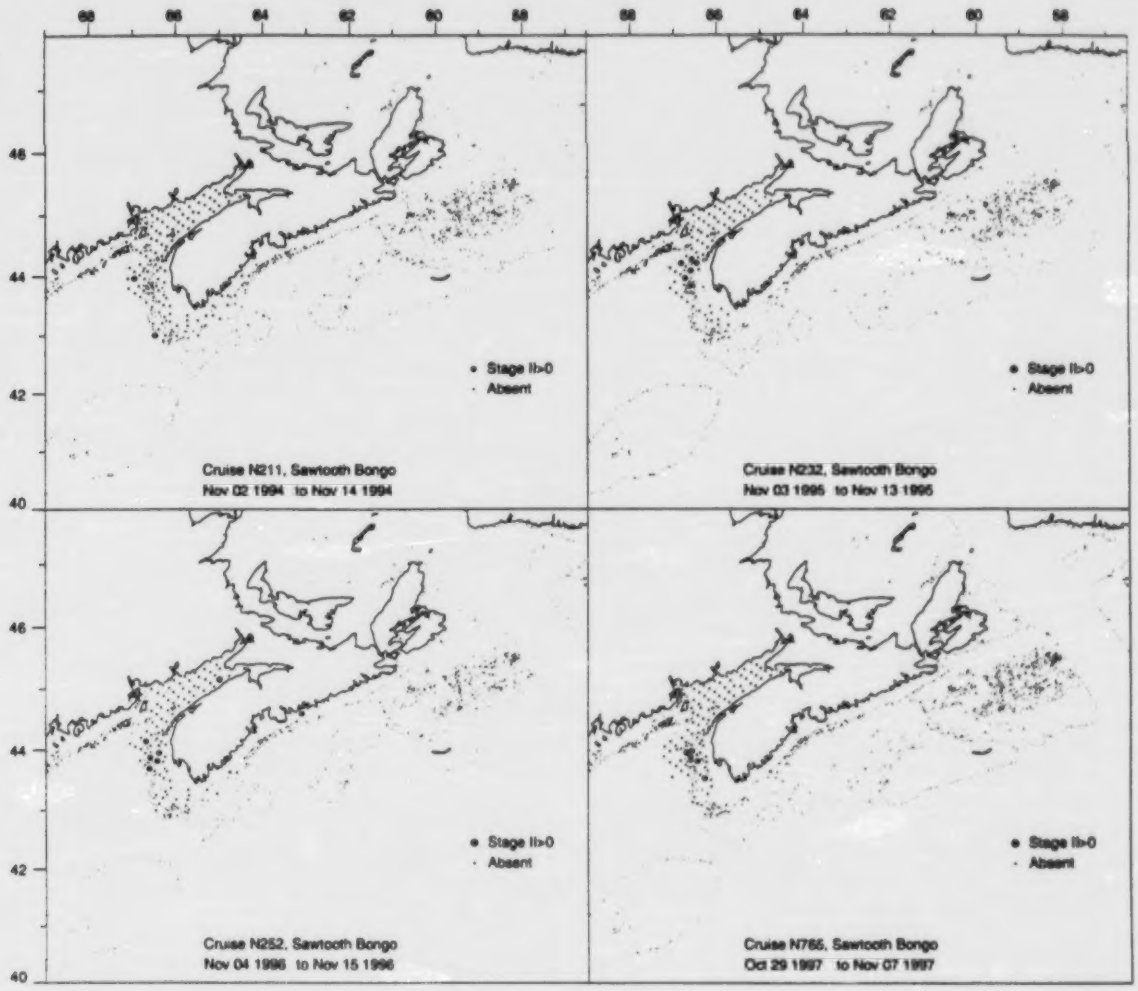


Fig. 8.1.2. (continued).

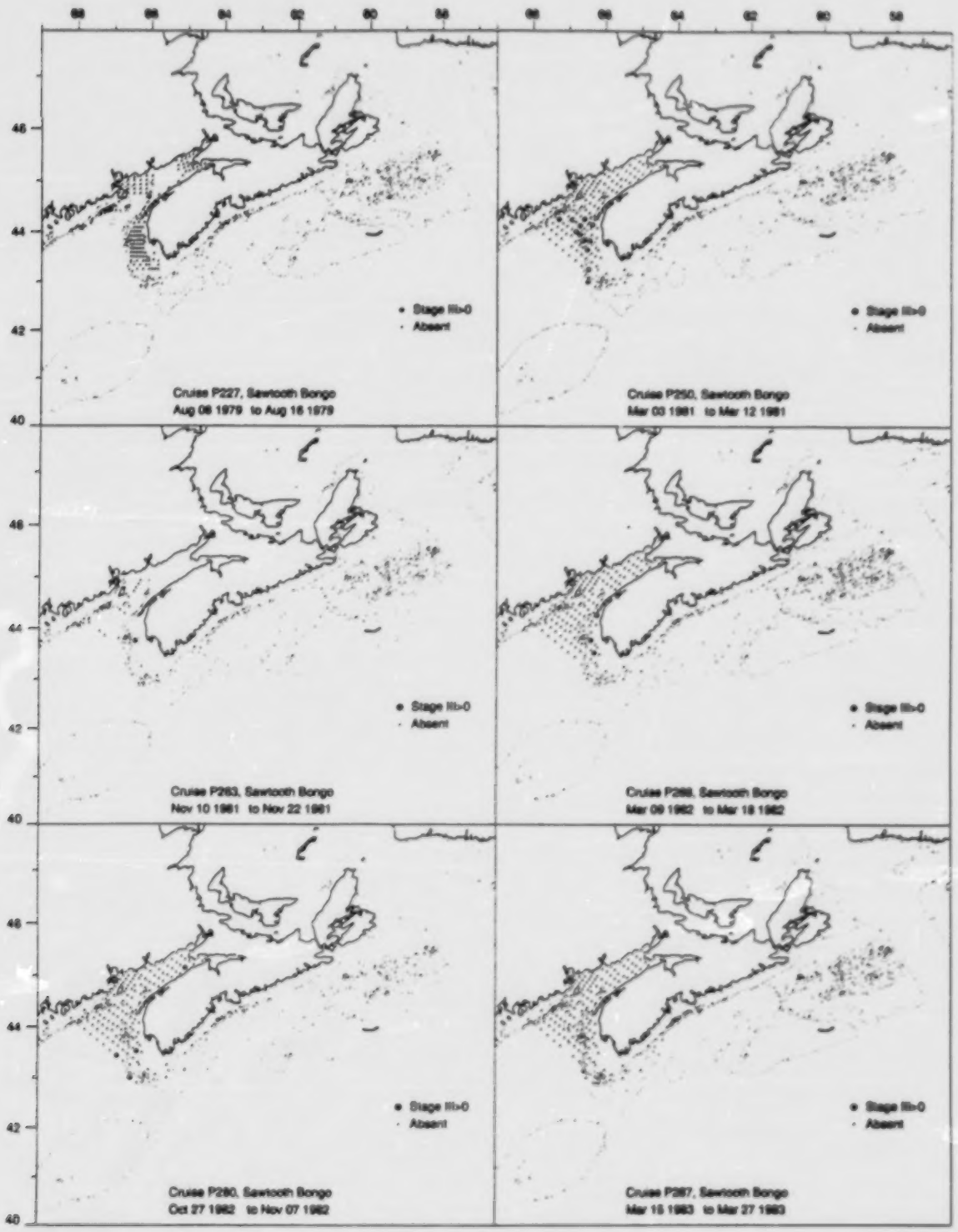

Stage III>0
Absent
Cruise P227, Sawtooth Bongo
Aug 06 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981
Cruise P263, Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P268, Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280, Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287, Sawtooth Bongo
Mar 15 1983 to Mar 27 1983

Fig. 8.1.3. Larval Herring Program-Bay of Fundy Cruises: Stage III pollock eggs.

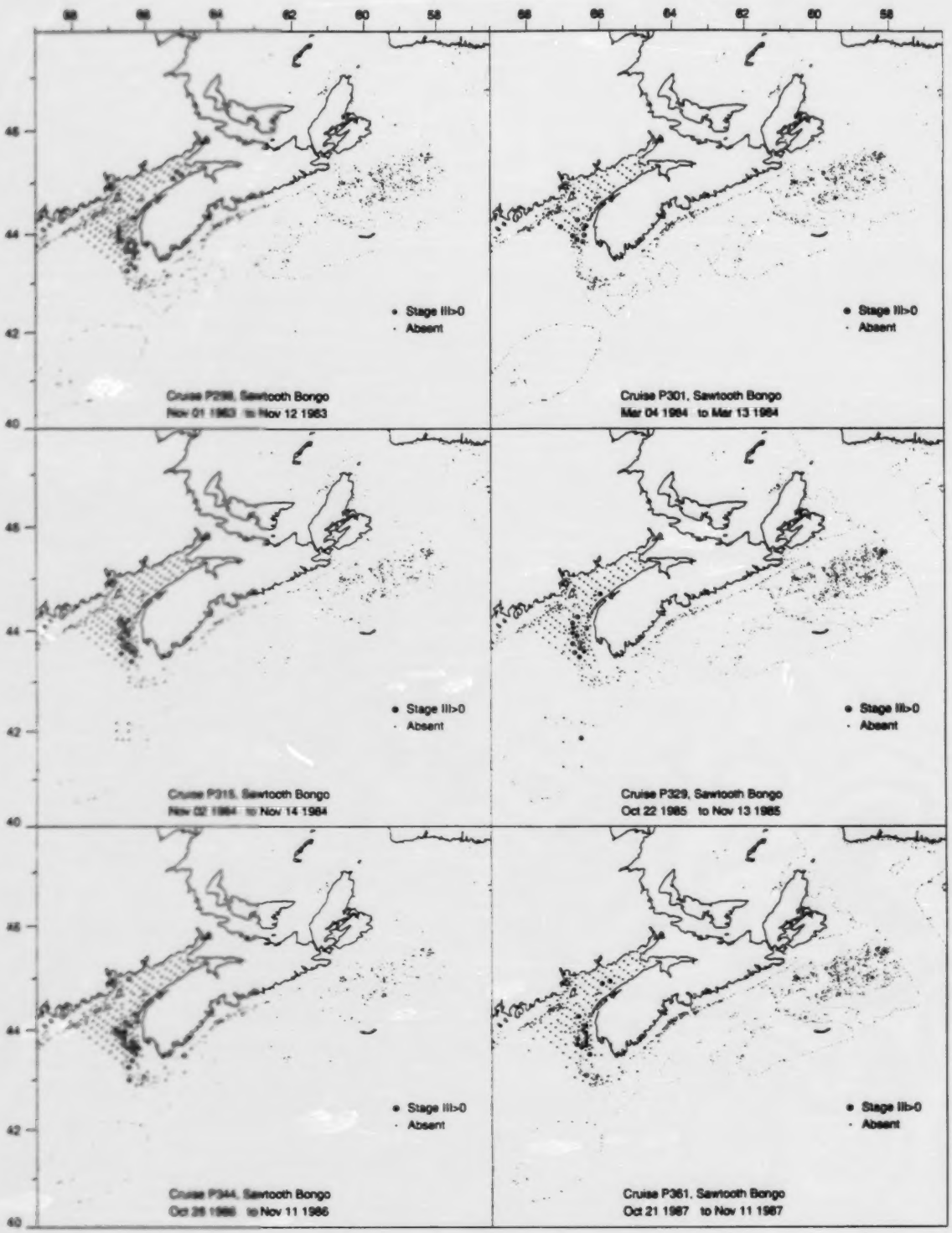

Stage IIIb>0
Absent
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 26 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987

Fig. 8.1.3. (continued).

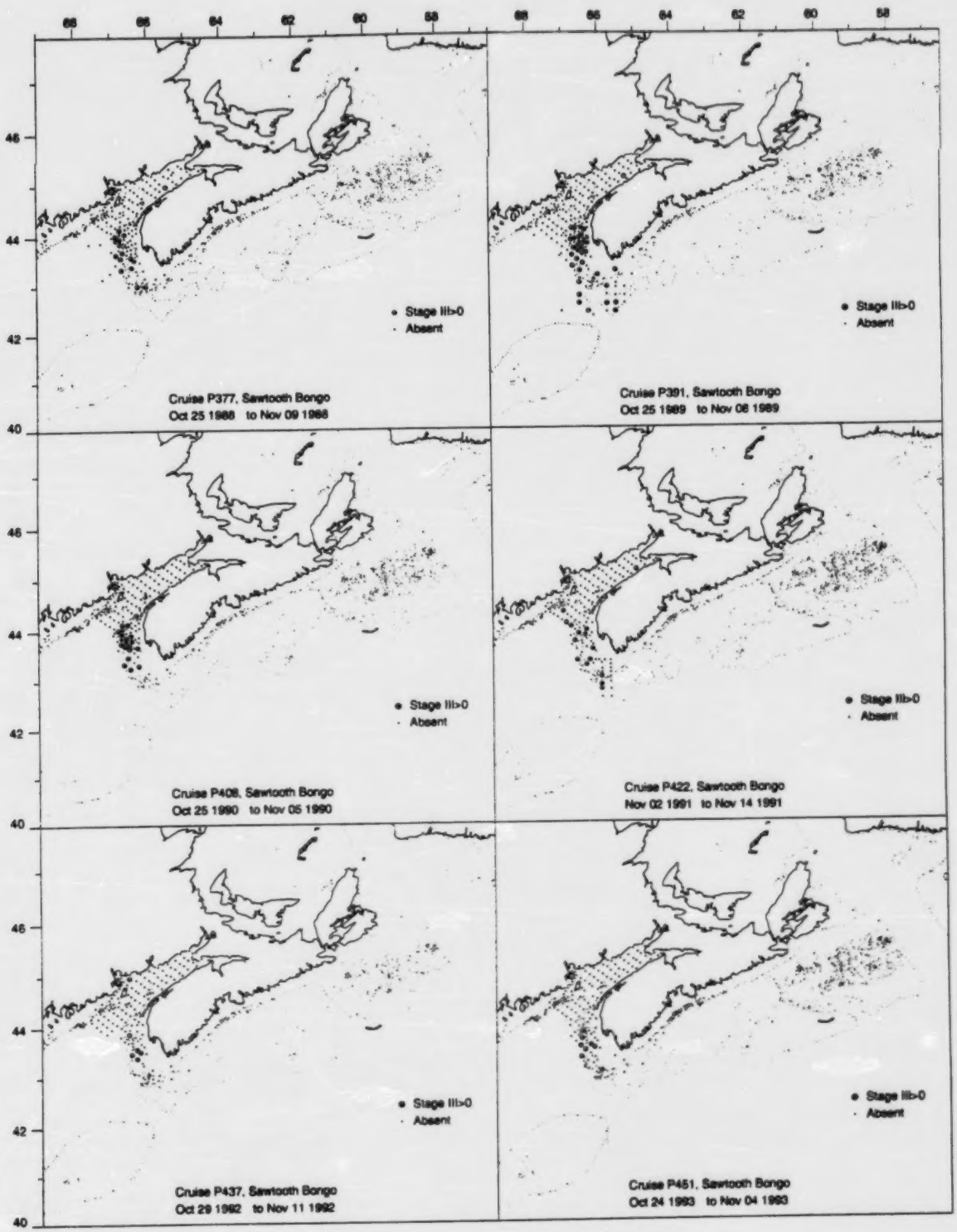

Stage IIb>0
Absent
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Oct 25 1989 to Nov 08 1989
Cruise P408, Sawtooth Bongo
Oct 25 1990 to Nov 05 1990
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993

Fig. 8.1.3. (continued).

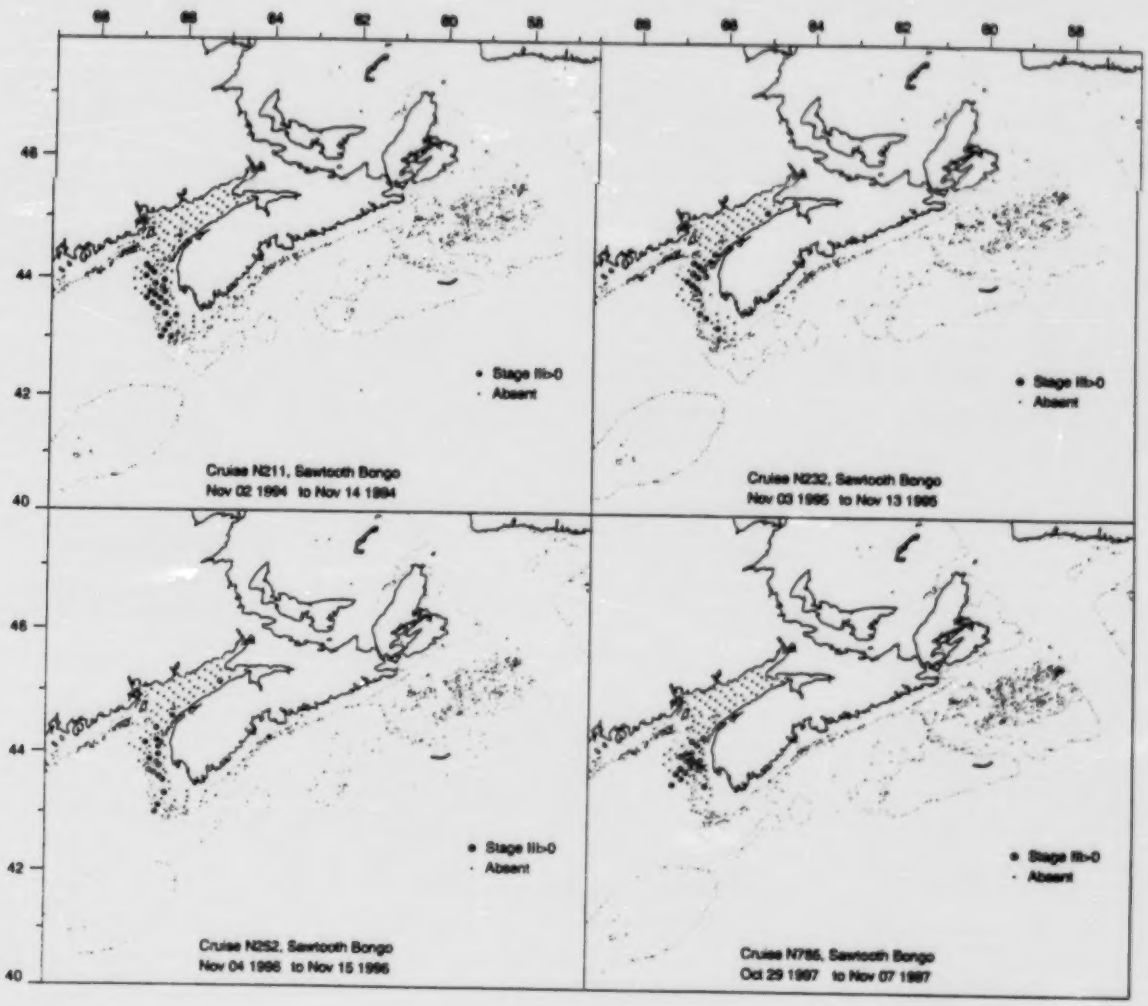


Fig. 8.1.3. (continued).

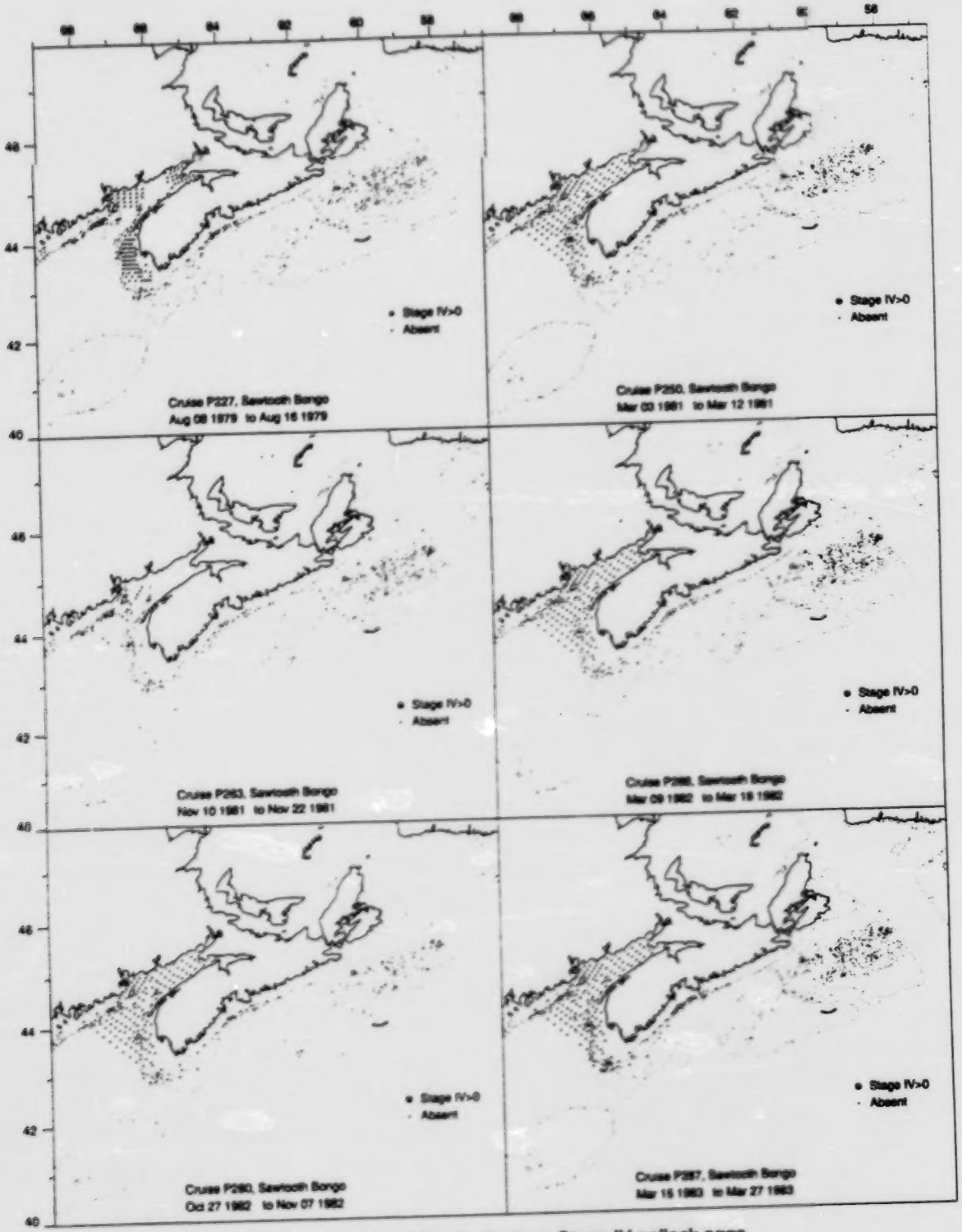

Stage IV>0
Absent
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981
Cruise P263, Sawtooth Bongo
Nov 10 1981 to Nov 22 1981
Cruise P280, Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287, Sawtooth Bongo
Mar 15 1983 to Mar 27 1983

Fig. 8.1.4. Larval Herring Program-Bay of Fundy Cruises: Stage IV pollock eggs.

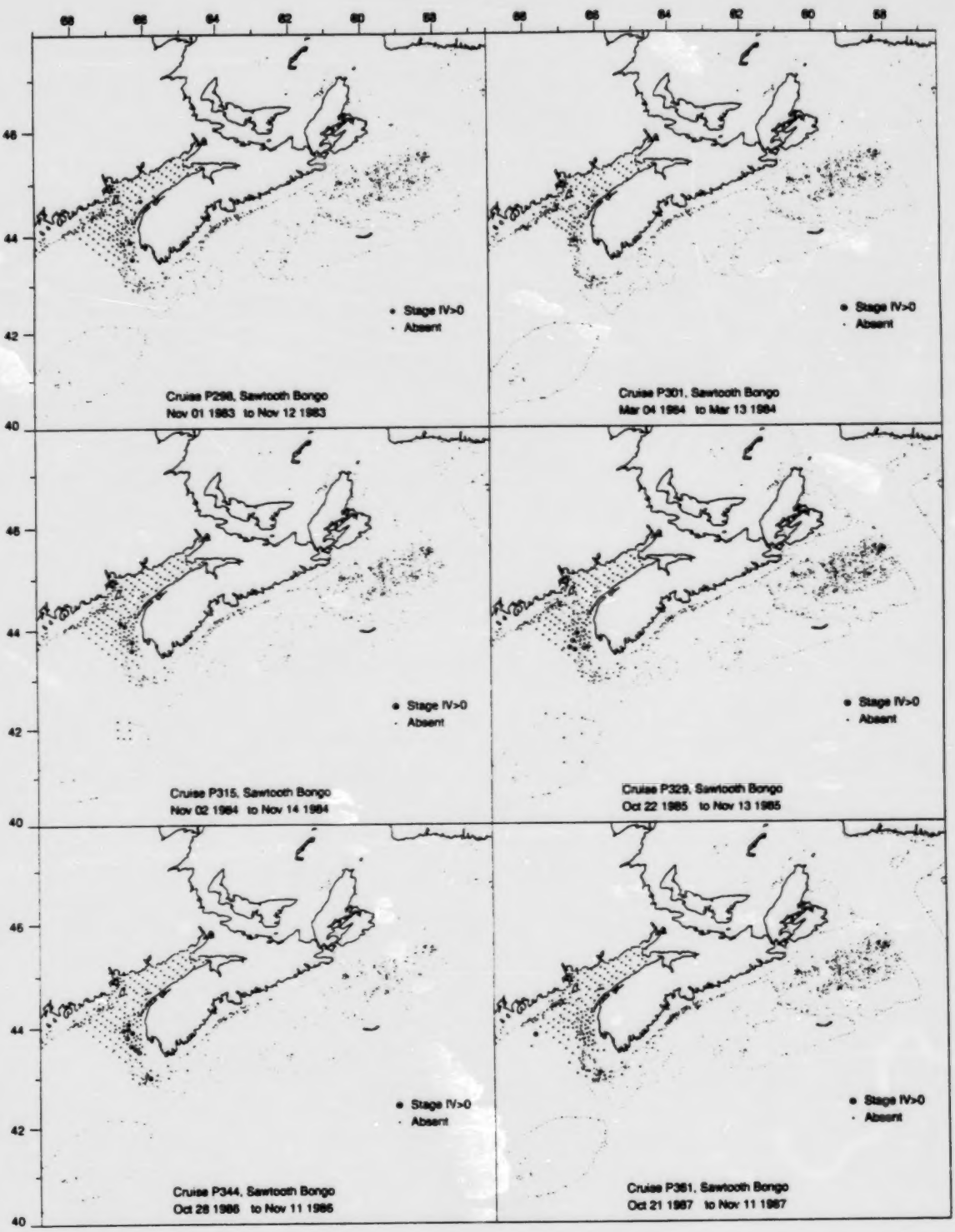
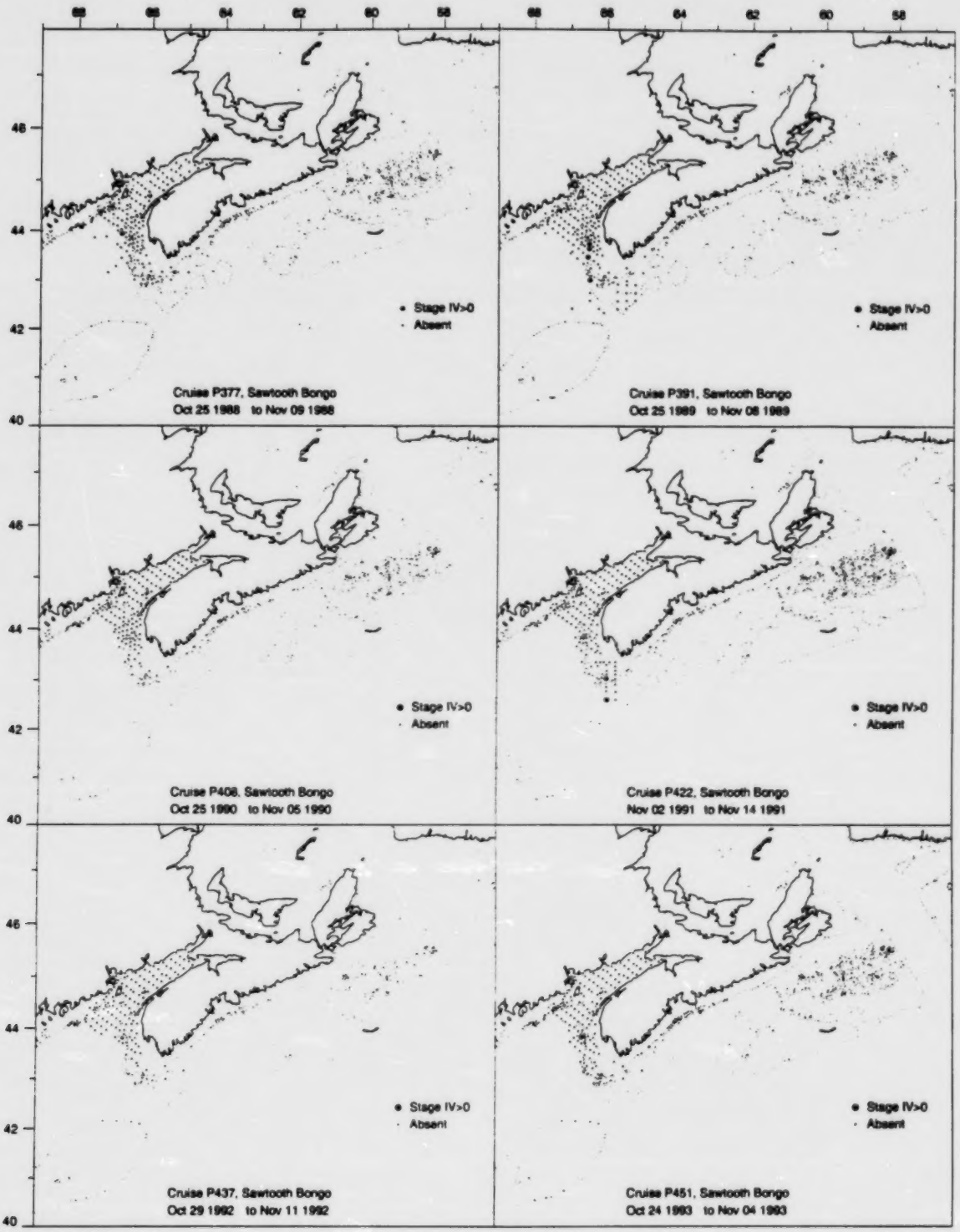

Stage IV>0
Absent
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Cruise P329, Sawtooth Bongo
Oct 22 1985 to Nov 13 1985
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987

Fig. 8.1.4. (continued).



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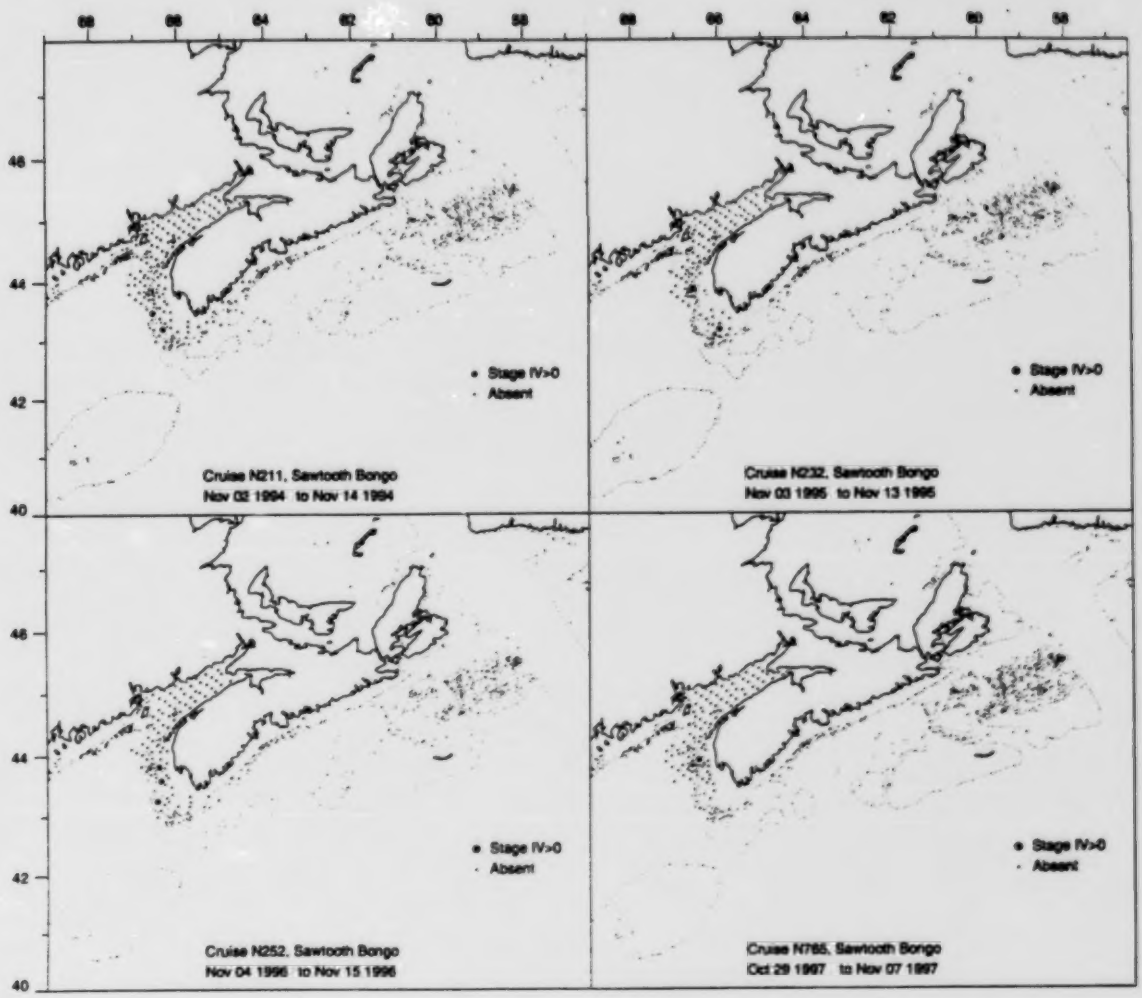
Stage IV>0
Absent
Cruise N211, Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232, Sawtooth Bongo
Nov 03 1995 to Nov 13 1995
Cruise N252, Sawtooth Bongo
Nov 04 1996 to Nov 15 1996
Cruise N765, Sawtooth Bongo
Oct 29 1997 to Nov 07 1997

Fig. 8.1.4. (continued).

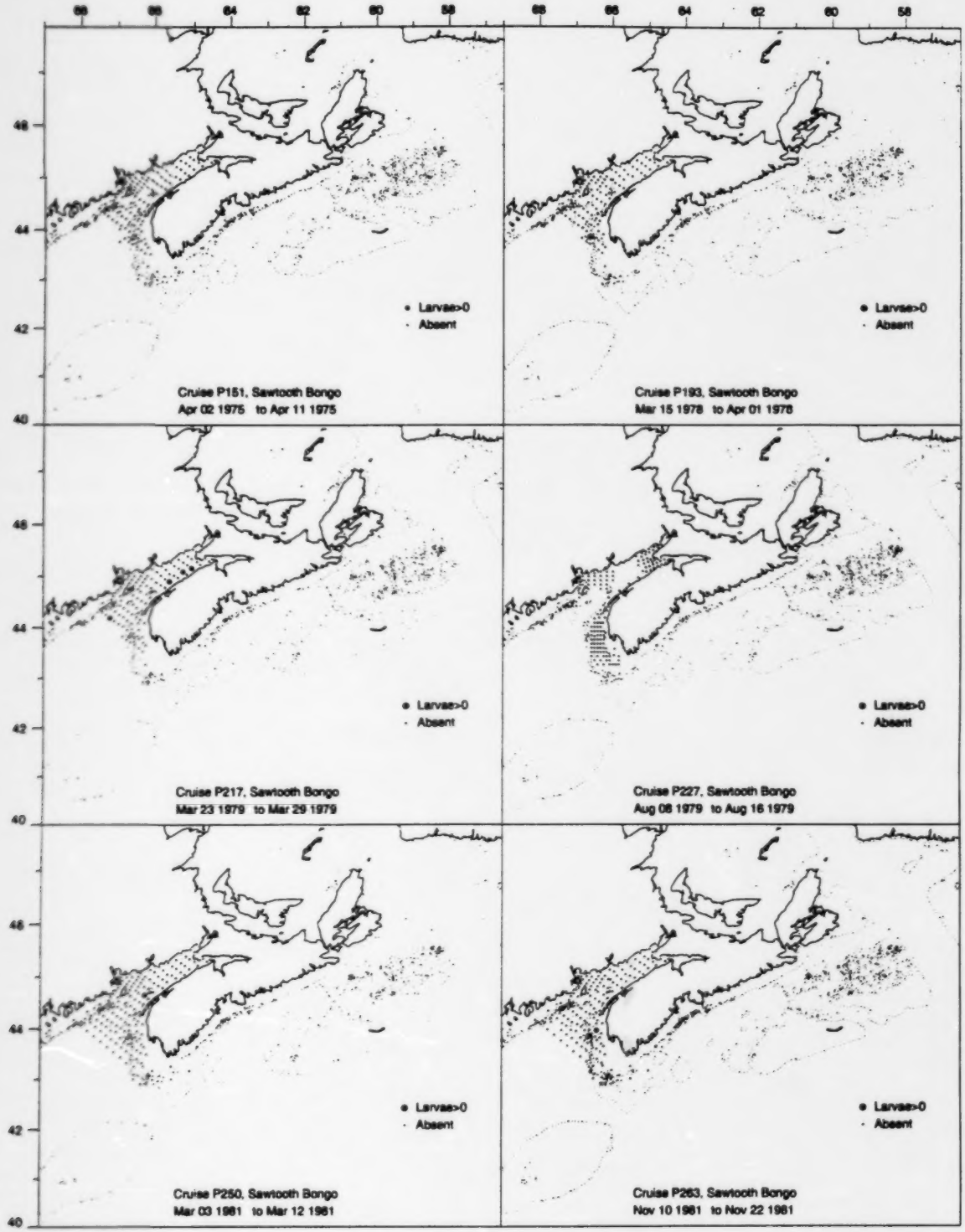
Larvae>0
Absent
Cruise P151, Sawtooth Bongo
Apr 02 1975 to Apr 11 1975
Cruise P193, Sawtooth Bongo
Mar 15 1978 to Apr 01 1978
Cruise P217, Sawtooth Bongo
Mar 23 1979 to Mar 29 1979
Cruise P227, Sawtooth Bongo
Aug 08 1979 to Aug 16 1979
Cruise P250, Sawtooth Bongo
Mar 03 1981 to Mar 12 1981
Cruise P263, Sawtooth Bongo
Nov 10 1981 to Nov 22 1981

Fig. 8.1.5. Larval Herring Program-Bay of Fundy Cruises: Pollock larvae (1-7mm).

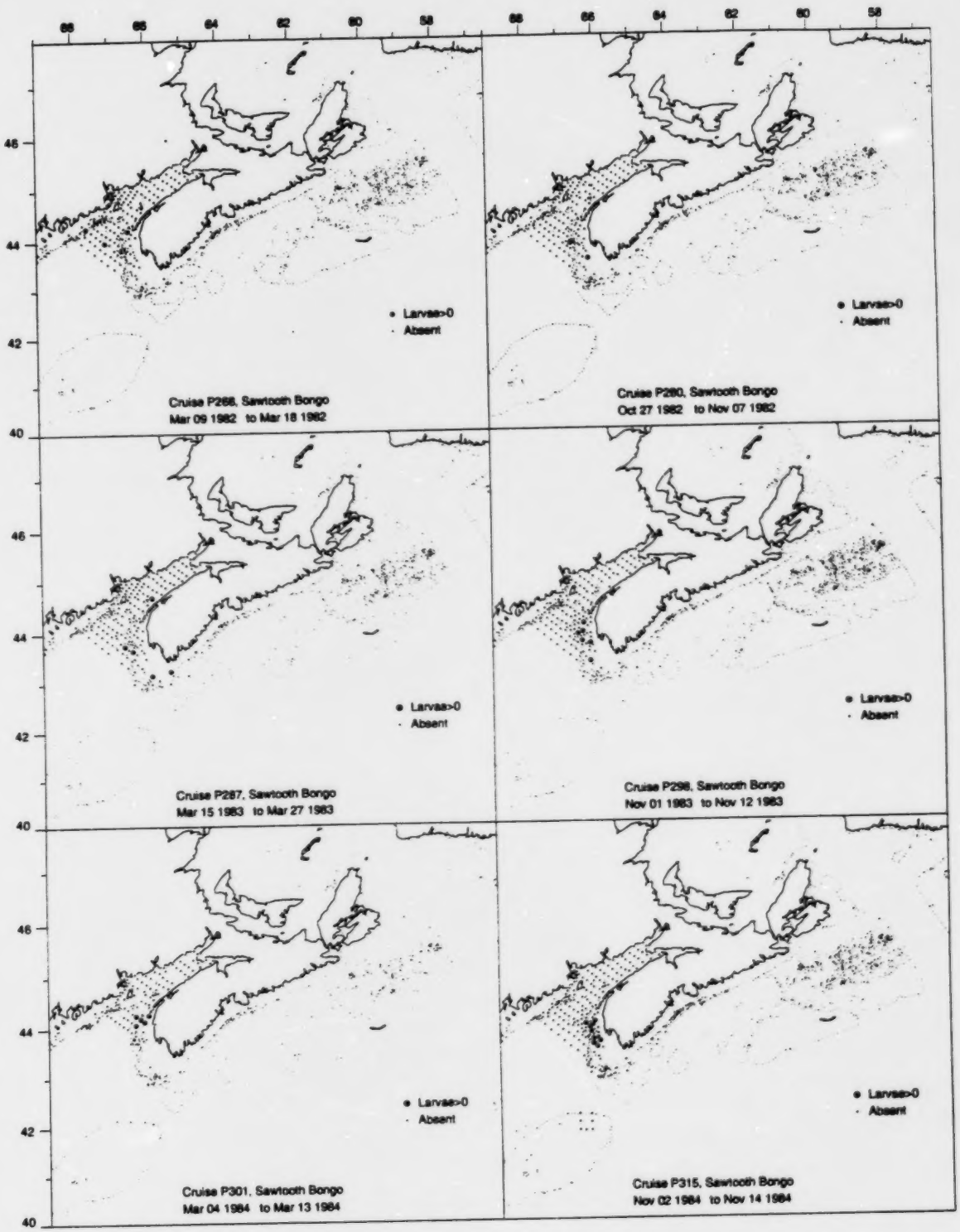
Larvae>0
Absent
Cruise P266, Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280, Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287, Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298, Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301, Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315, Sawtooth Bongo
Nov 02 1984 to Nov 14 1984

Fig. 8.1.5. (continued).

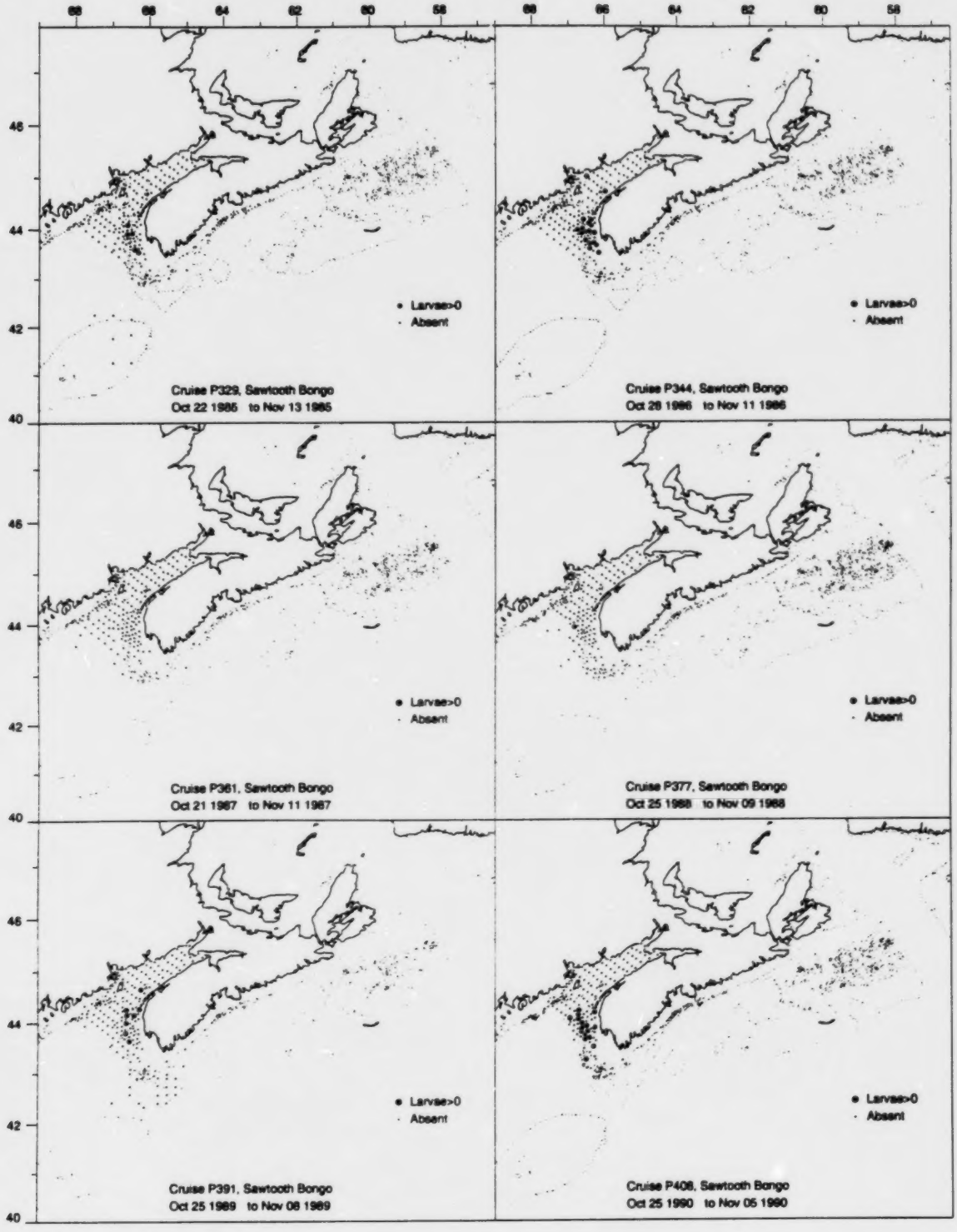

Fig. 8.1.5. (continued).

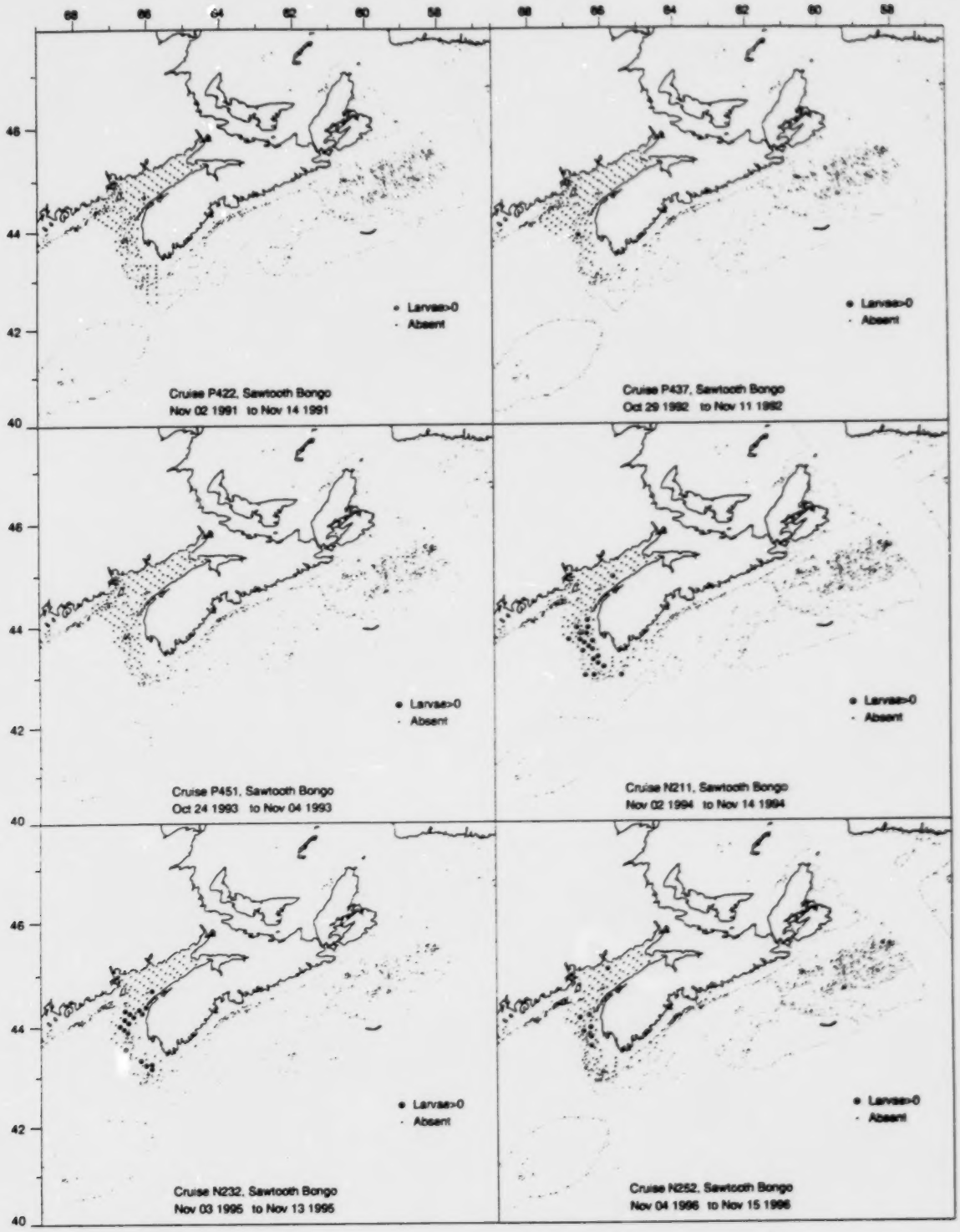
Larvae>0
Absent
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211, Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232, Sawtooth Bongo
Nov 03 1995 to Nov 13 1995
Cruise N252, Sawtooth Bongo
Nov 04 1996 to Nov 15 1996

Fig. 8.1.5. (continued).

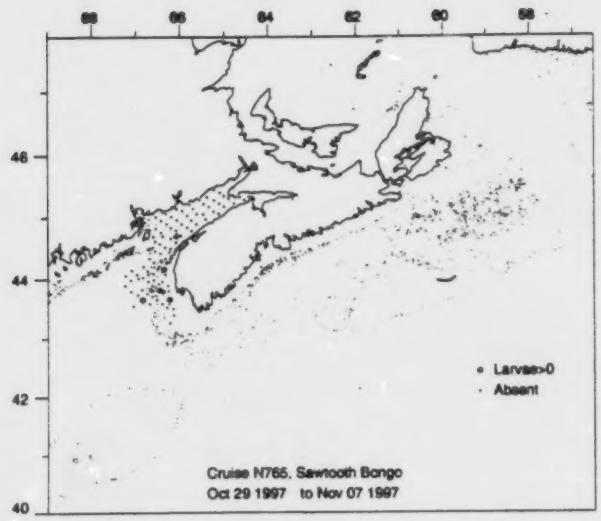

Fig. 8.1.5. (continued).

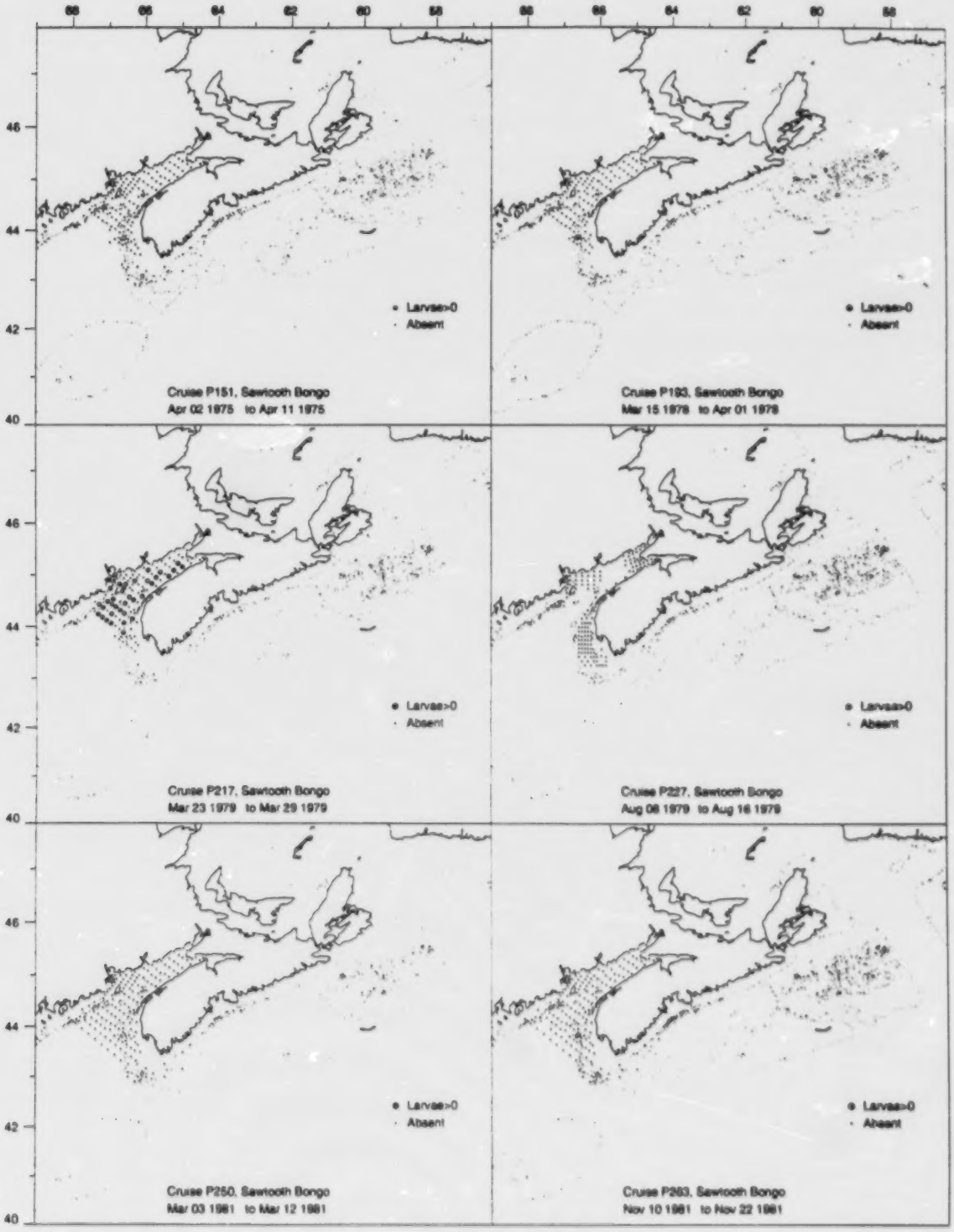

Fig. 8.1.6. Larval Herring Program-Bay of Fundy Cruises: Pollock larvae (7+mm).

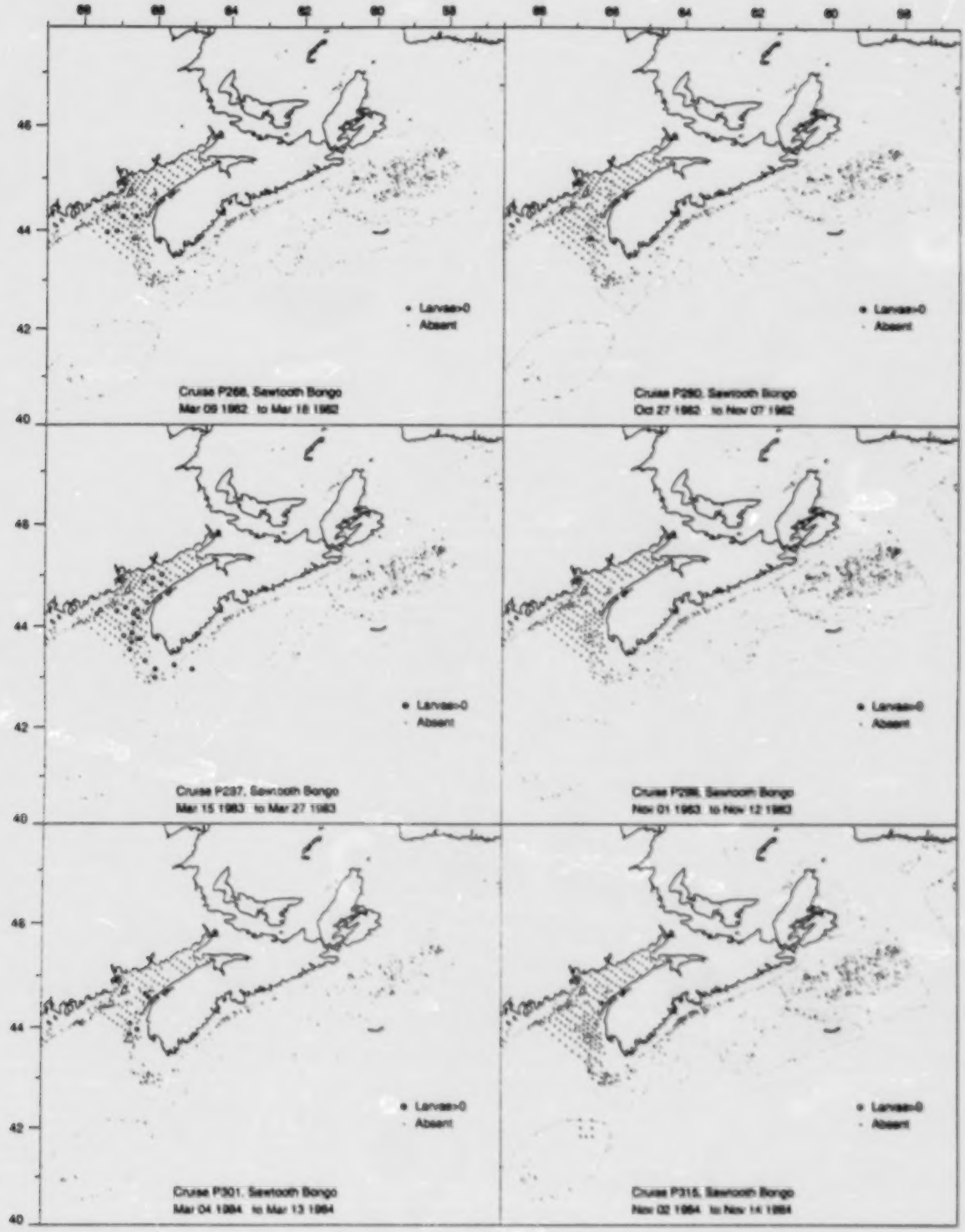
Cruise P268. Sawtooth Bongo
Mar 09 1982 to Mar 18 1982
Cruise P280. Sawtooth Bongo
Oct 27 1982 to Nov 07 1982
Cruise P287. Sawtooth Bongo
Mar 15 1983 to Mar 27 1983
Cruise P298. Sawtooth Bongo
Nov 01 1983 to Nov 12 1983
Cruise P301. Sawtooth Bongo
Mar 04 1984 to Mar 13 1984
Cruise P315. Sawtooth Bongo
Nov 02 1984 to Nov 14 1984
Larvae>0
Absent

Fig. 8.1.6. (continued).

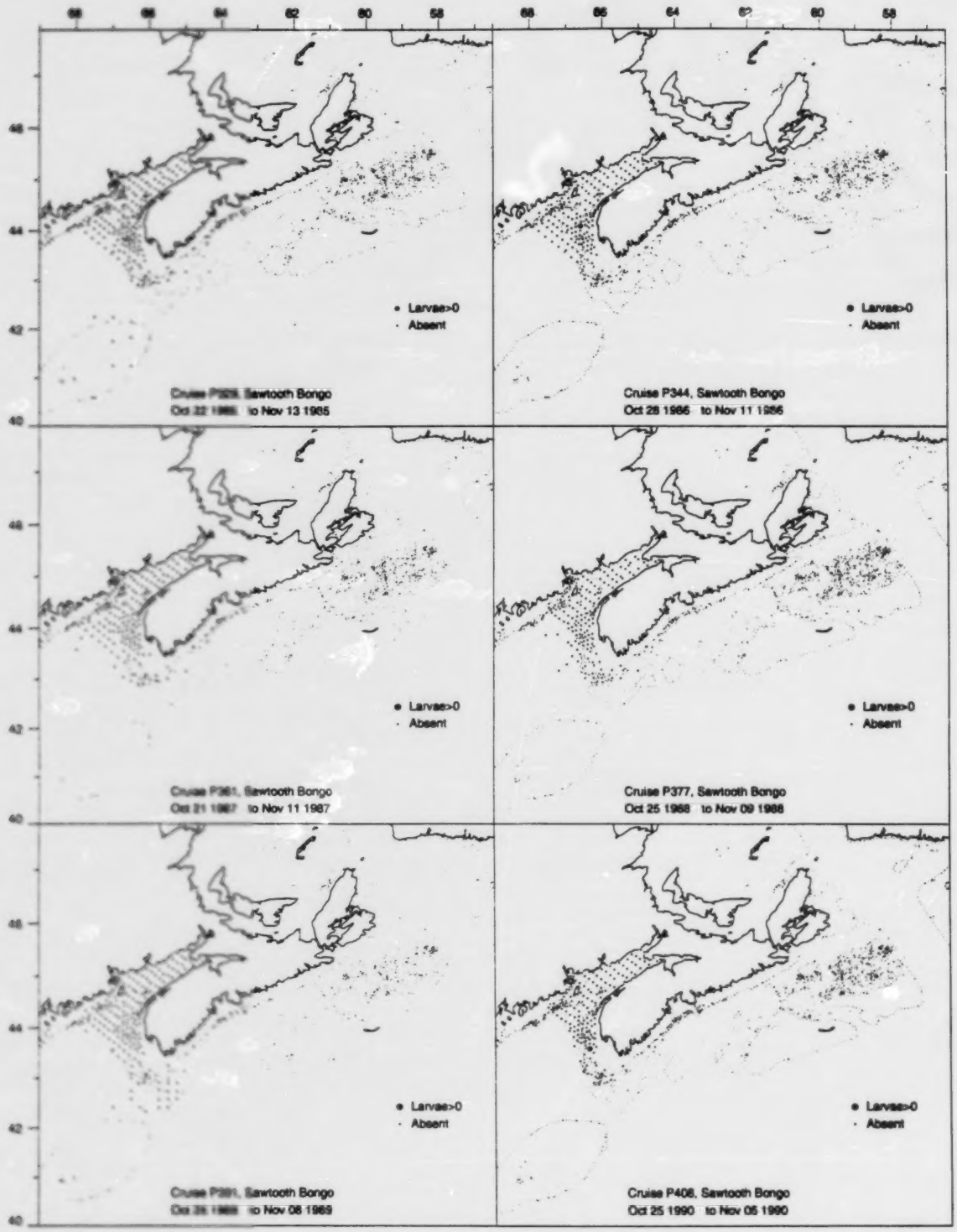
Larvae>0
Absent
Cruise P344, Sawtooth Bongo
Oct 28 1986 to Nov 11 1986
Cruise P361, Sawtooth Bongo
Oct 21 1987 to Nov 11 1987
Cruise P377, Sawtooth Bongo
Oct 25 1988 to Nov 09 1988
Cruise P391, Sawtooth Bongo
Cruise P408, Sawtooth Bongo
Oct 25 1990 to Nov 05 1990

Fig. 8.1.6. (continued).

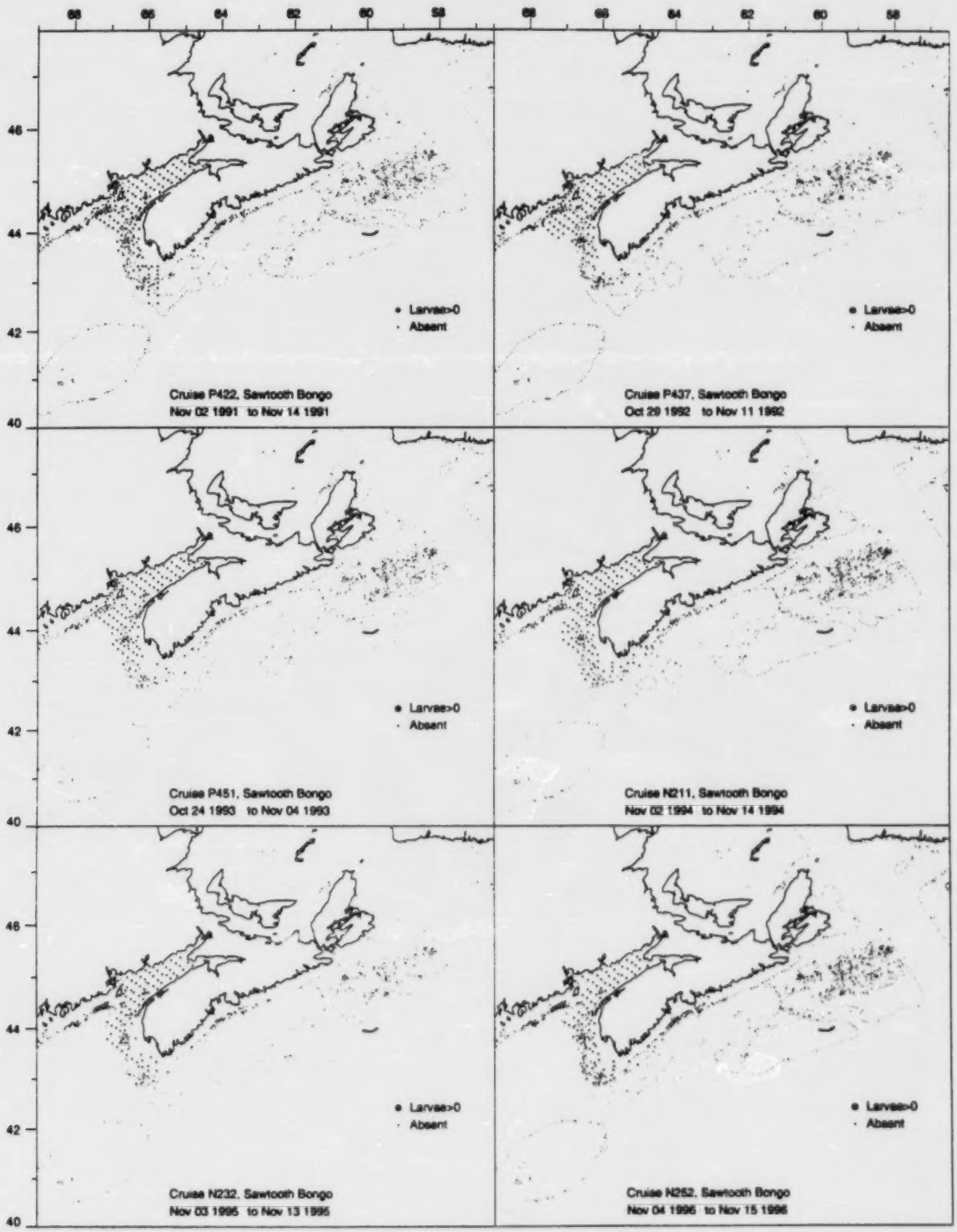
Larvae>0
Absent
Cruise P422, Sawtooth Bongo
Nov 02 1991 to Nov 14 1991
Cruise P437, Sawtooth Bongo
Oct 29 1992 to Nov 11 1992
Cruise P451, Sawtooth Bongo
Oct 24 1993 to Nov 04 1993
Cruise N211, Sawtooth Bongo
Nov 02 1994 to Nov 14 1994
Cruise N232, Sawtooth Bongo
Nov 03 1995 to Nov 13 1995
Cruise N252, Sawtooth Bongo
Nov 04 1996 to Nov 15 1996

Fig. 8.1.6. (continued).

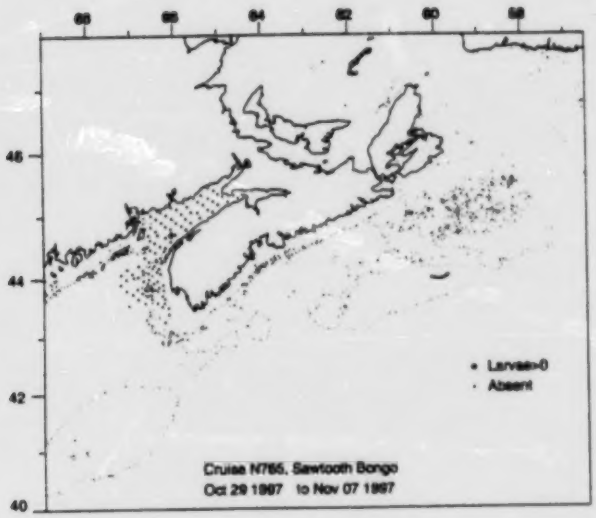

Fig. 8.1.6. (continued).

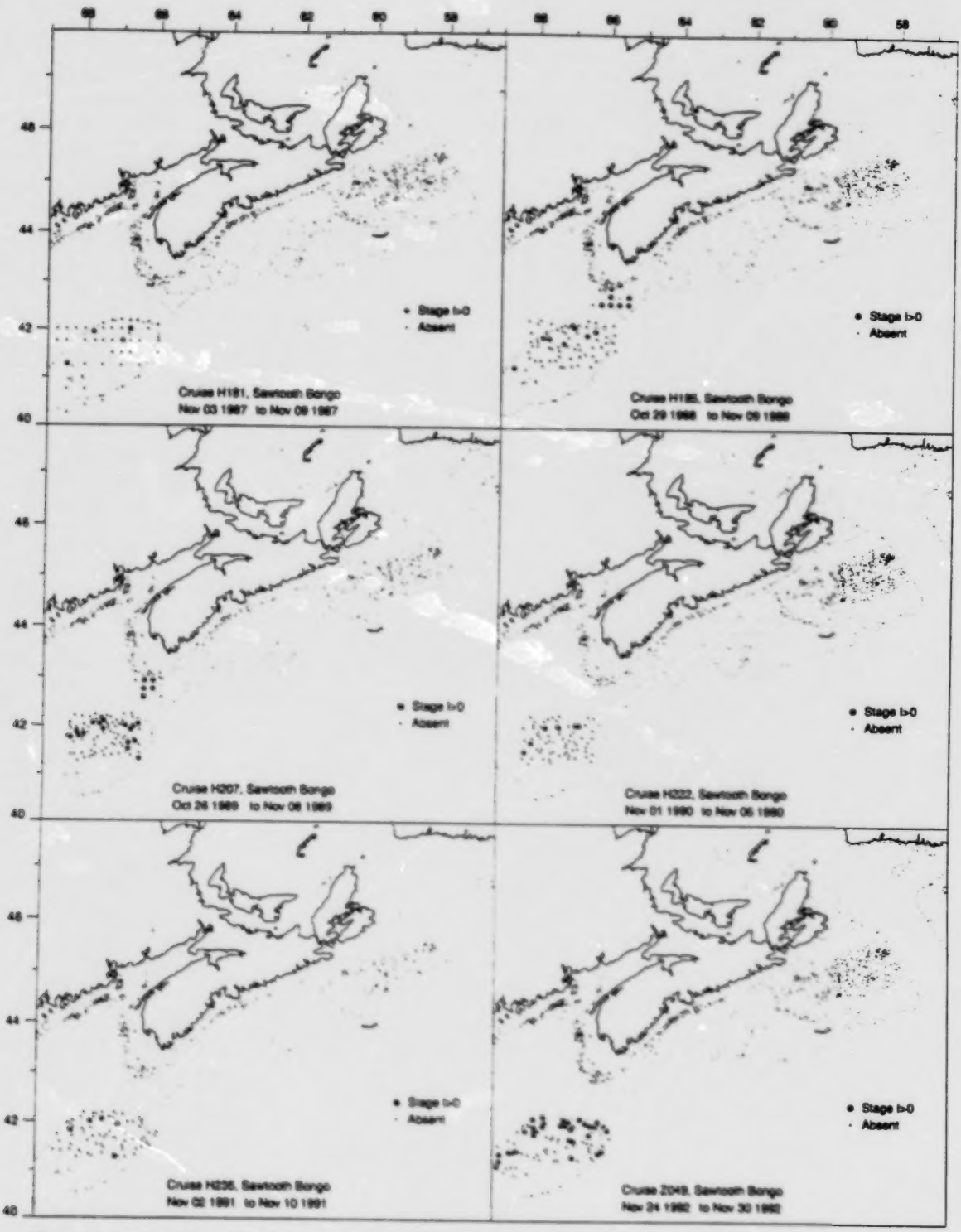
Stage I>0
Absent
Cruise H191, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 06 1990
Cruise H236, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.1. Larval Herring Program-Georges Bank Cruises: Stage I pollock eggs.

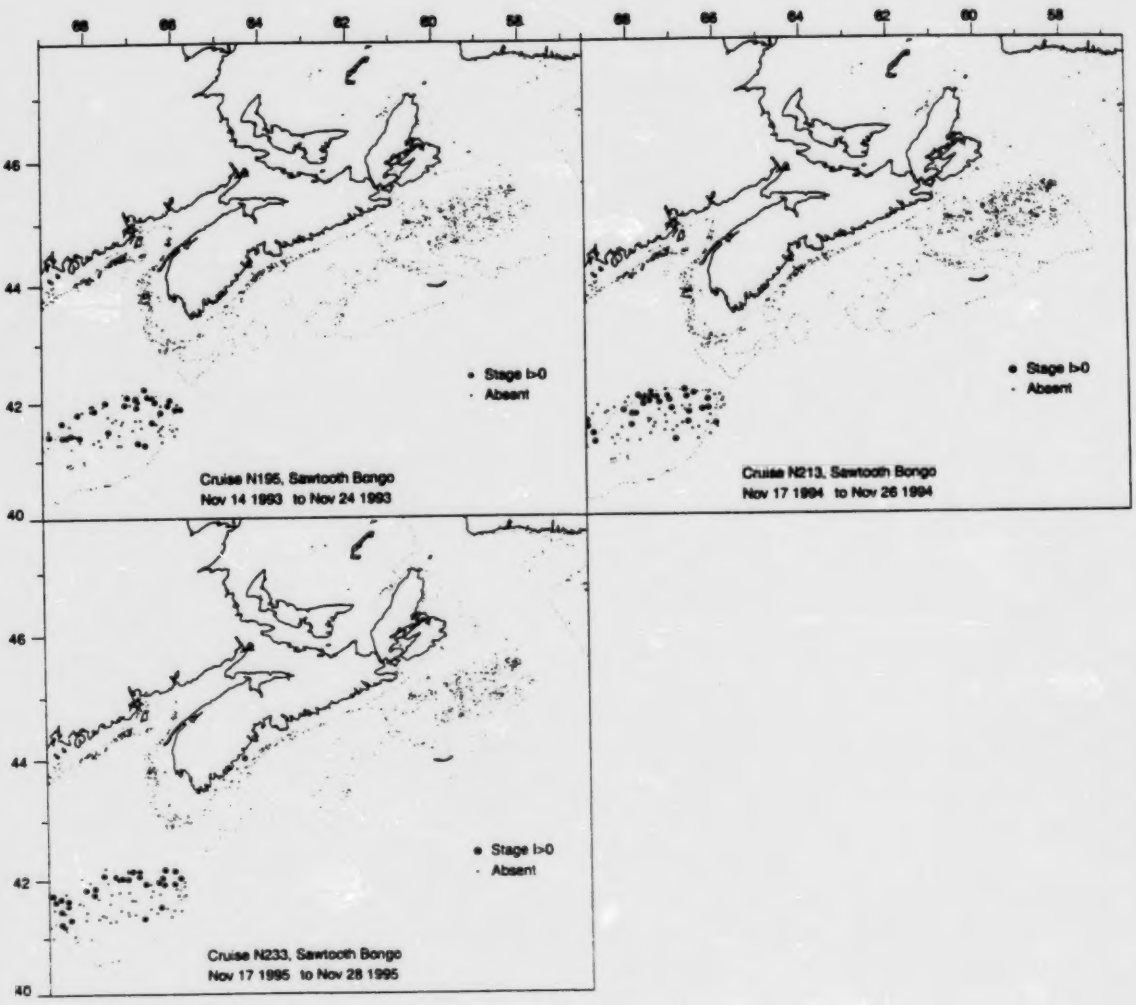

Fig. 8.2.1. (continued).

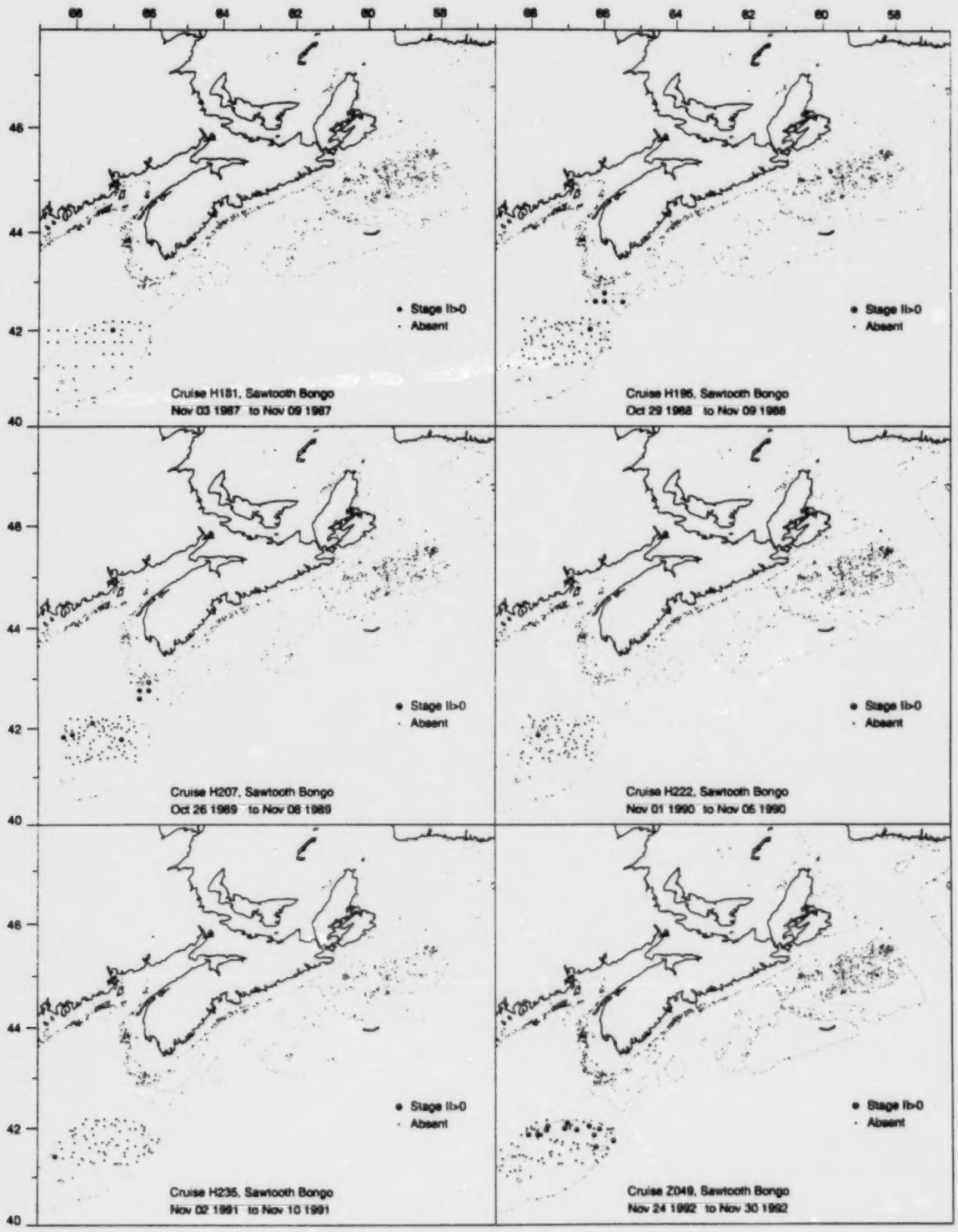
Stage II>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.2. Larval Herring Program-Georges Bank Cruises: Stage II pollock eggs.

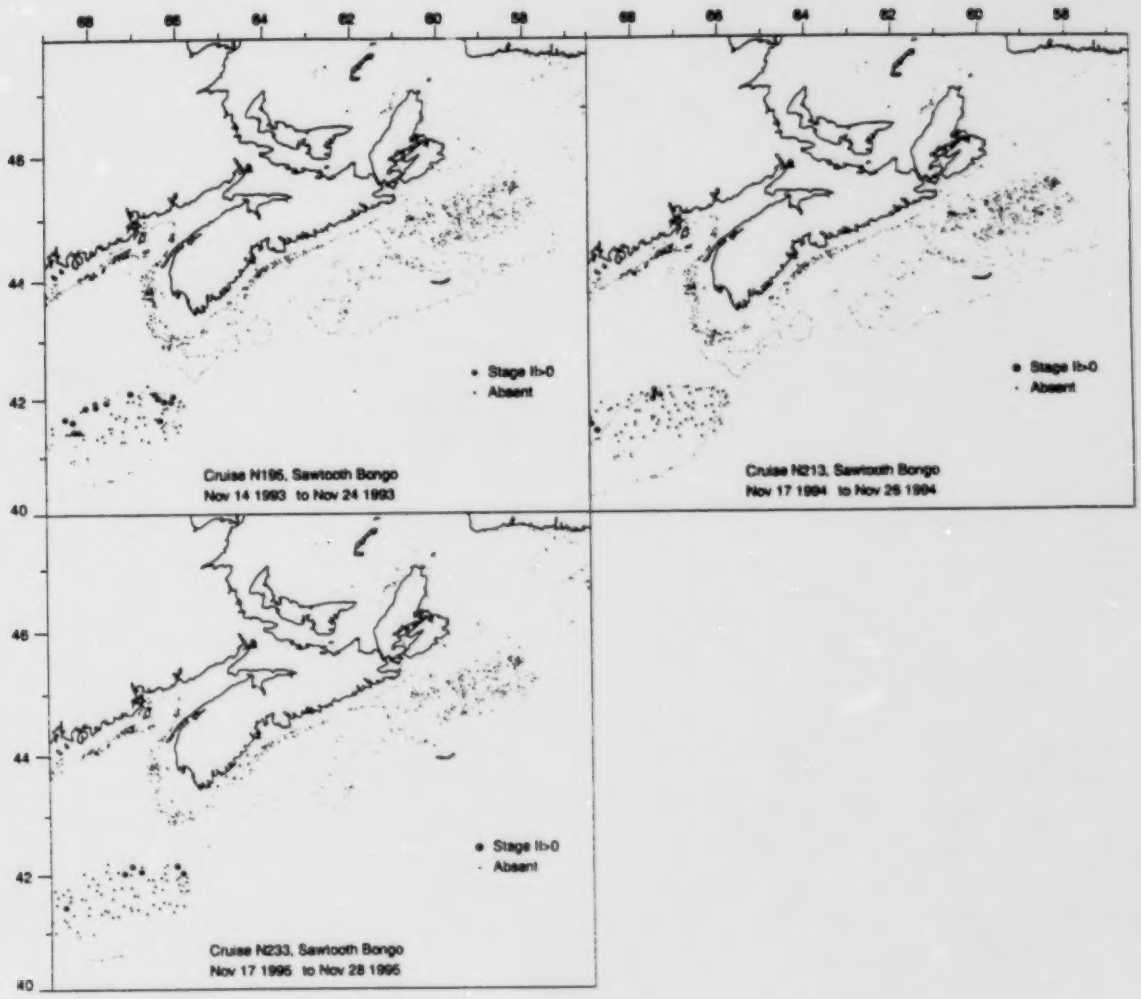

Fig. 8.2.2. (continued).

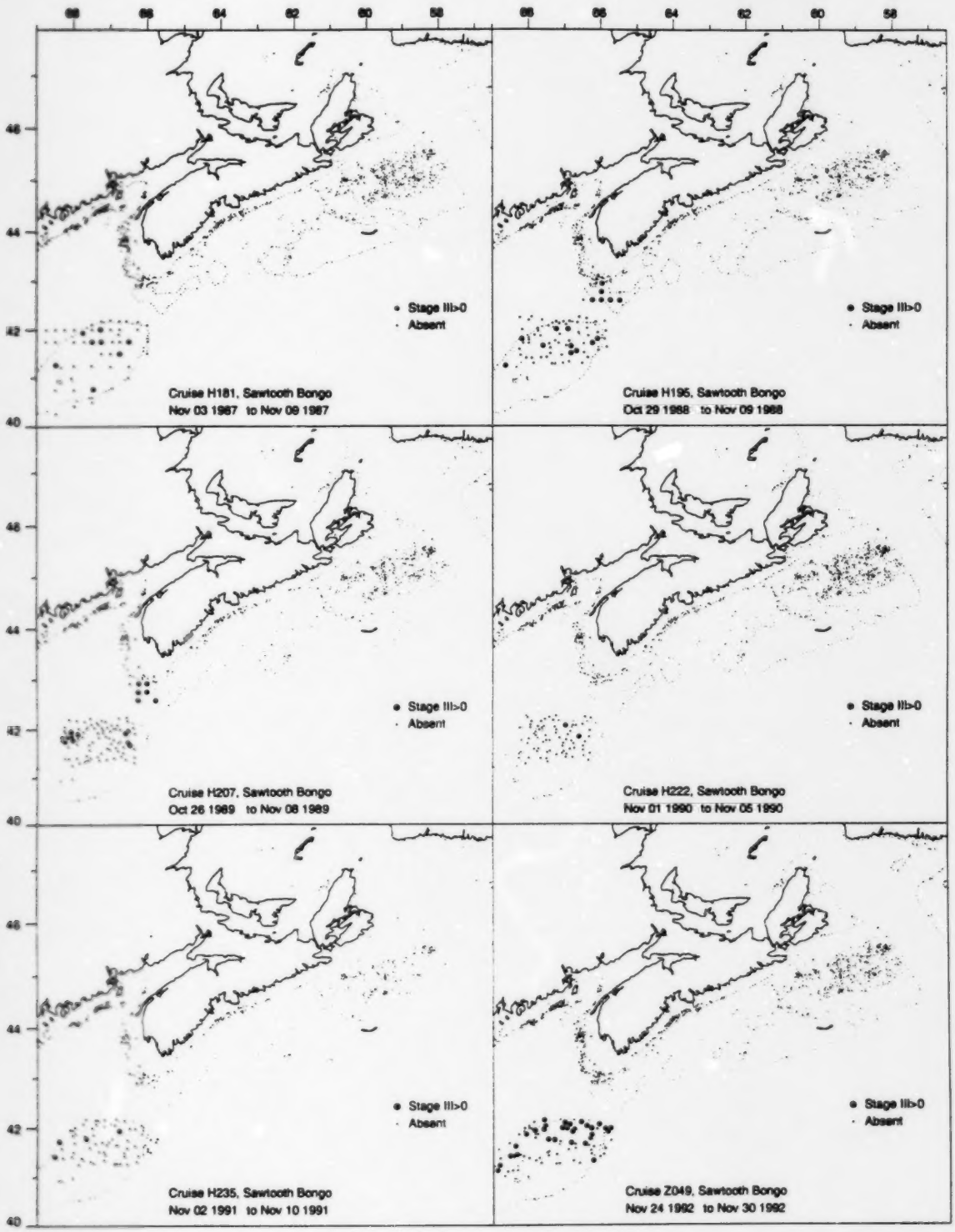
Stage IIIb>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.3. Larval Herring Program-Georges Bank Cruises: Stage III pollock eggs.

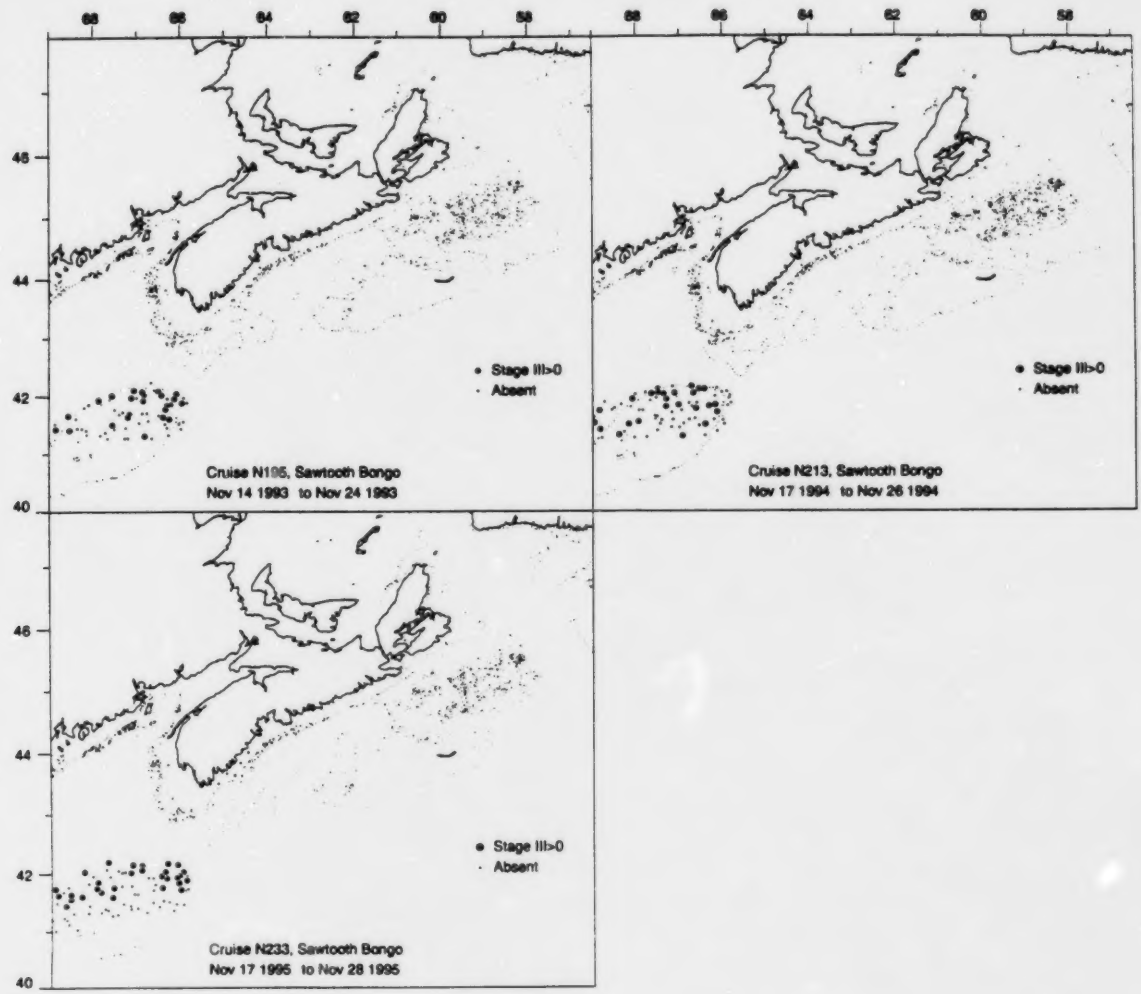

Fig. 8.2.3. (continued).

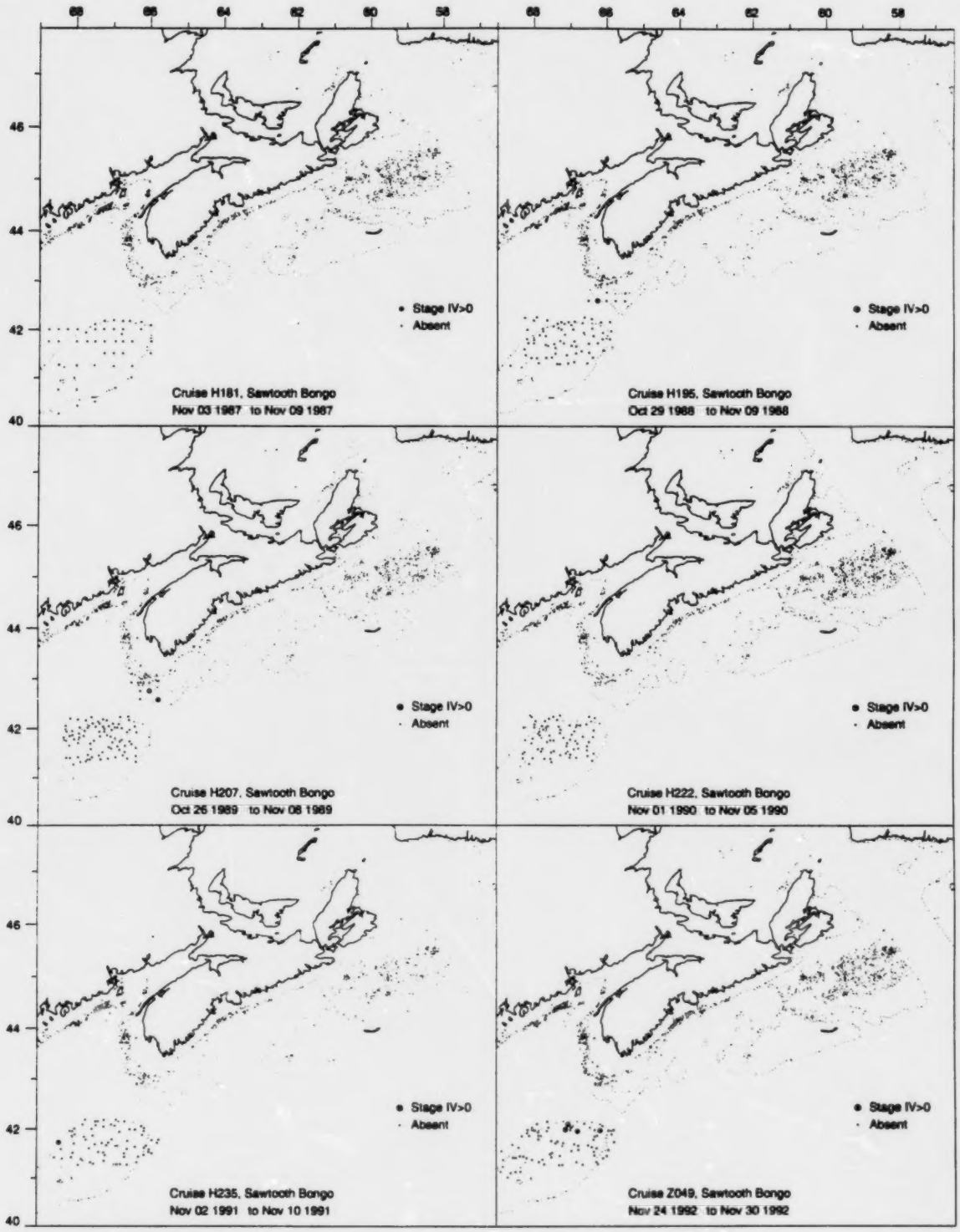

Fig. 8.2.4. Larval Herring Program-Georges Bank Cruises: Stage IV pollock eggs.

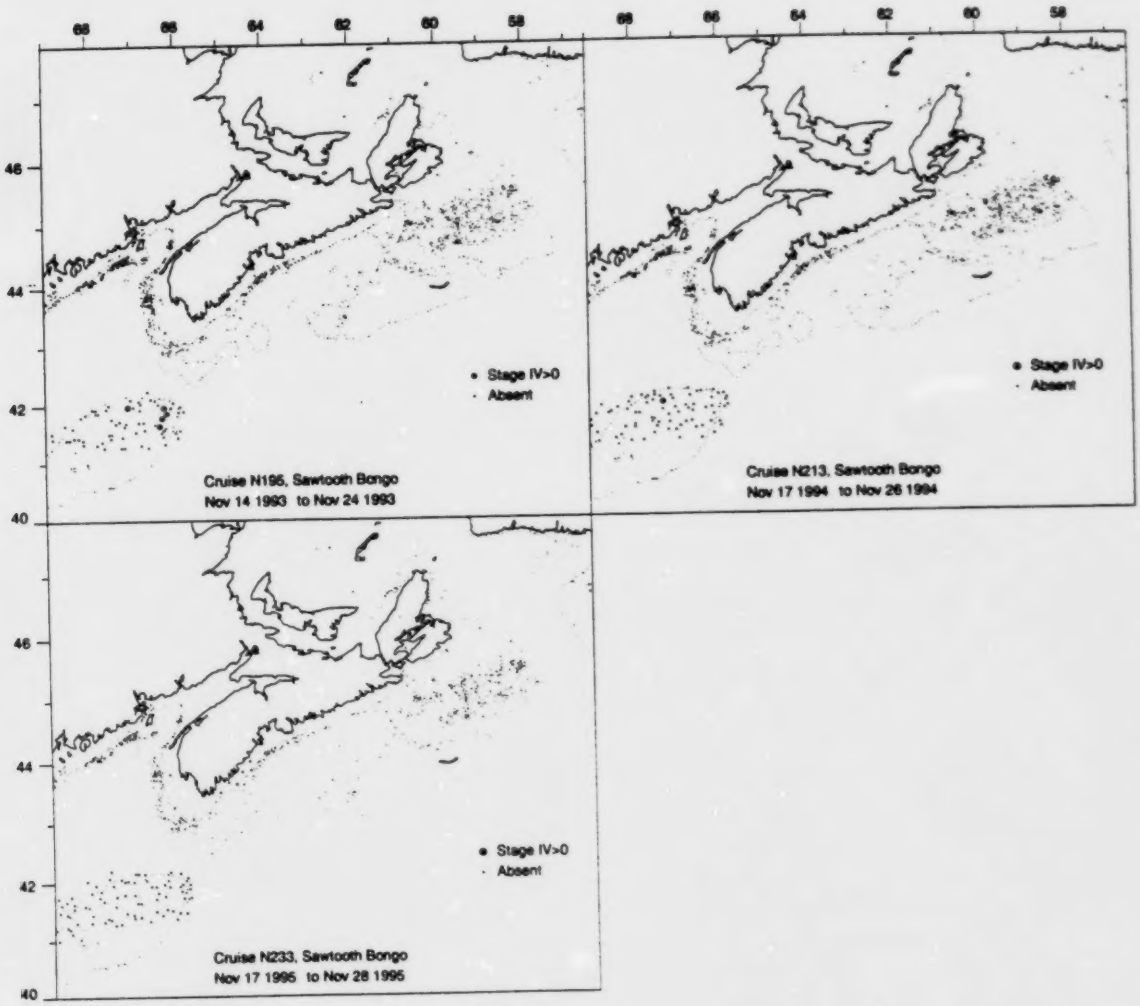

Fig. 8.2.4. (continued).

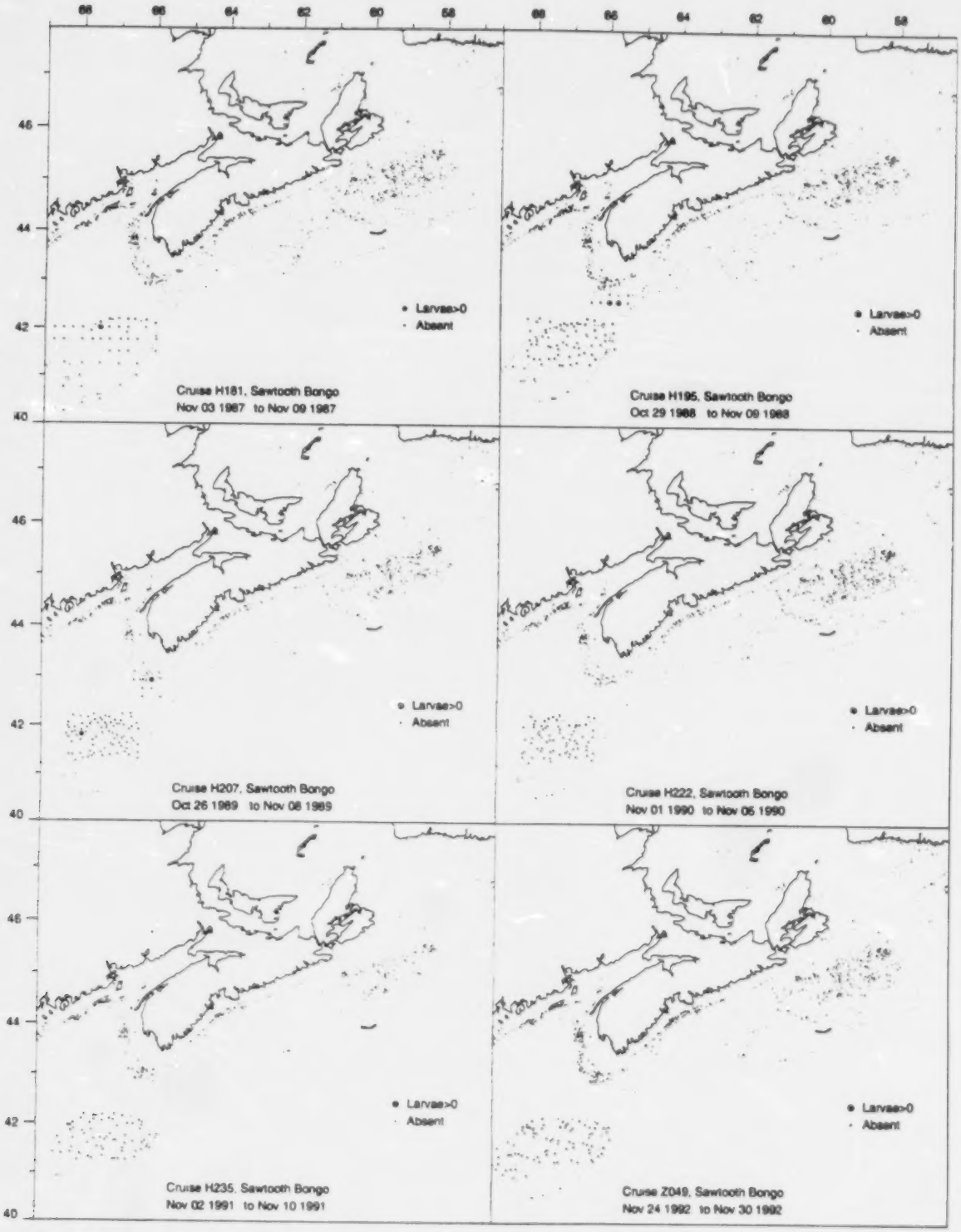
Larvae>0
Absent
Cruise H181, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.5. Larval Herring Program-Georges Bank Cruises: Pollock larvae (1-7mm).

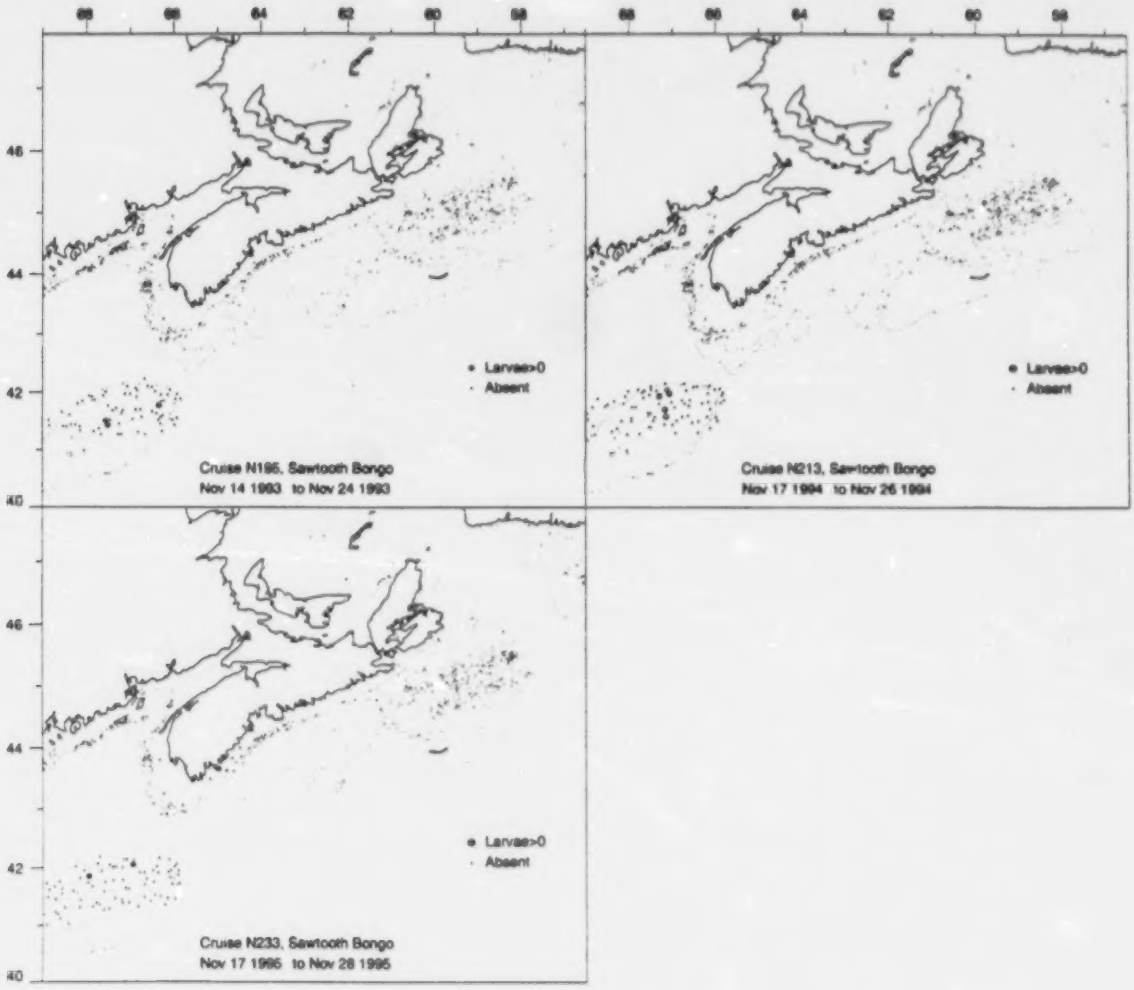

Fig. 8.2.5. (continued).

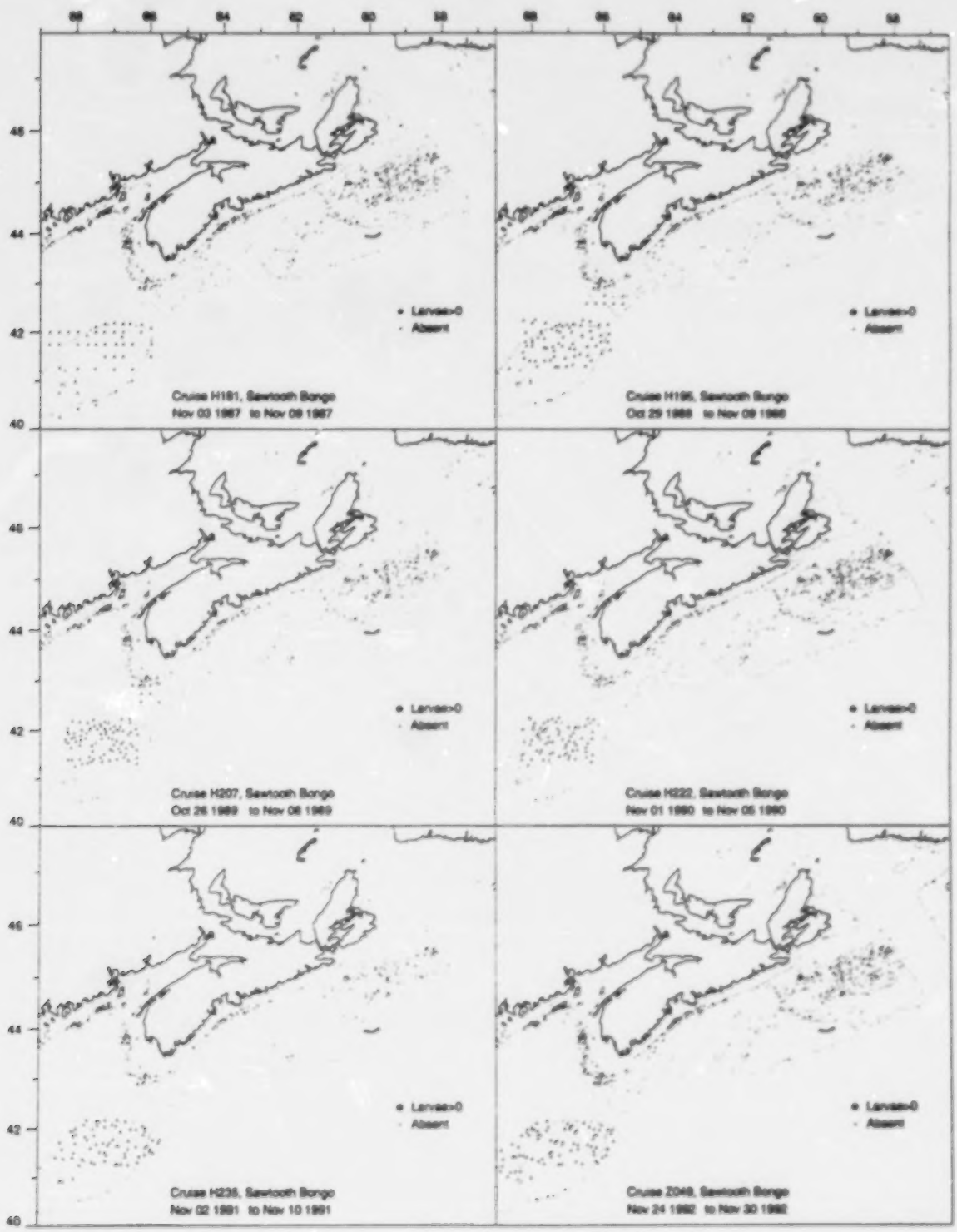
Larvae>0
Absent
Cruise H191, Sawtooth Bongo
Nov 03 1987 to Nov 09 1987
Cruise H195, Sawtooth Bongo
Oct 29 1988 to Nov 09 1988
Cruise H207, Sawtooth Bongo
Oct 26 1989 to Nov 08 1989
Cruise H222, Sawtooth Bongo
Nov 01 1990 to Nov 05 1990
Cruise H235, Sawtooth Bongo
Nov 02 1991 to Nov 10 1991
Cruise Z049, Sawtooth Bongo
Nov 24 1992 to Nov 30 1992

Fig. 8.2.6. Larval Herring Program-Georges Bank Cruises: Pollock larvae (7+mm).

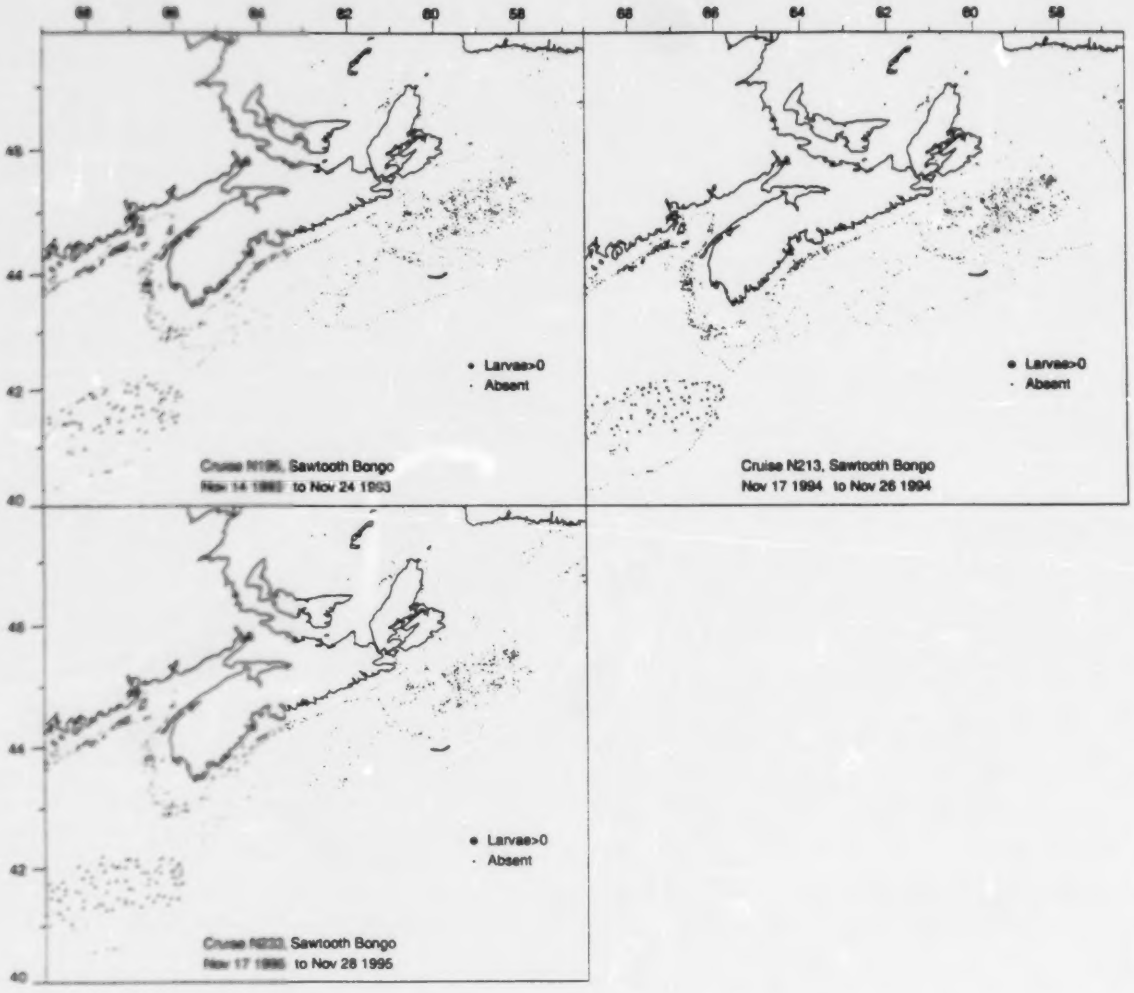

Fig. 8.2.6. (continued).

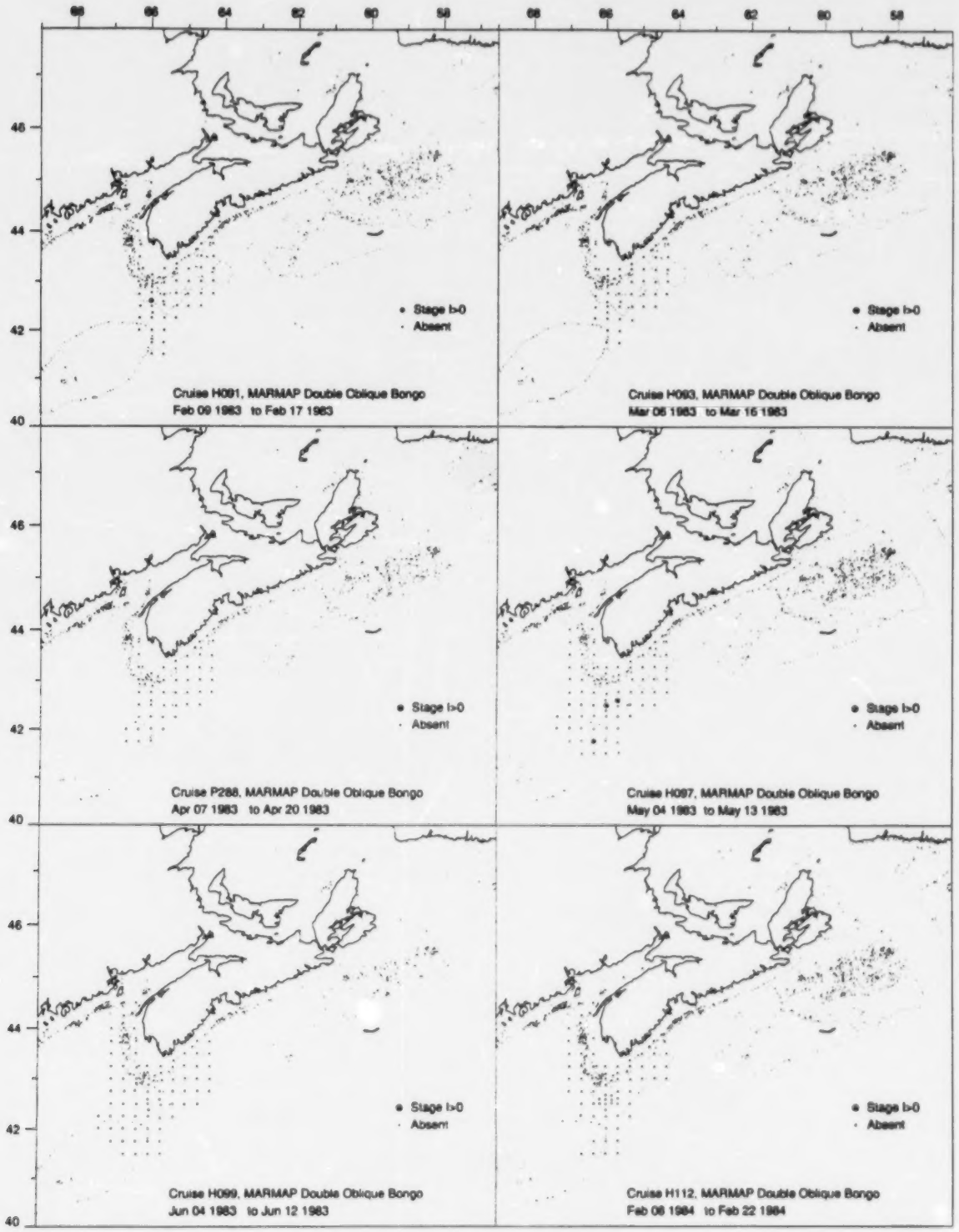
Stage I>0
Absent
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 06 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984

Fig. 8.3.1. Fisheries Ecology Program Cruises: Stage I pollock eggs.

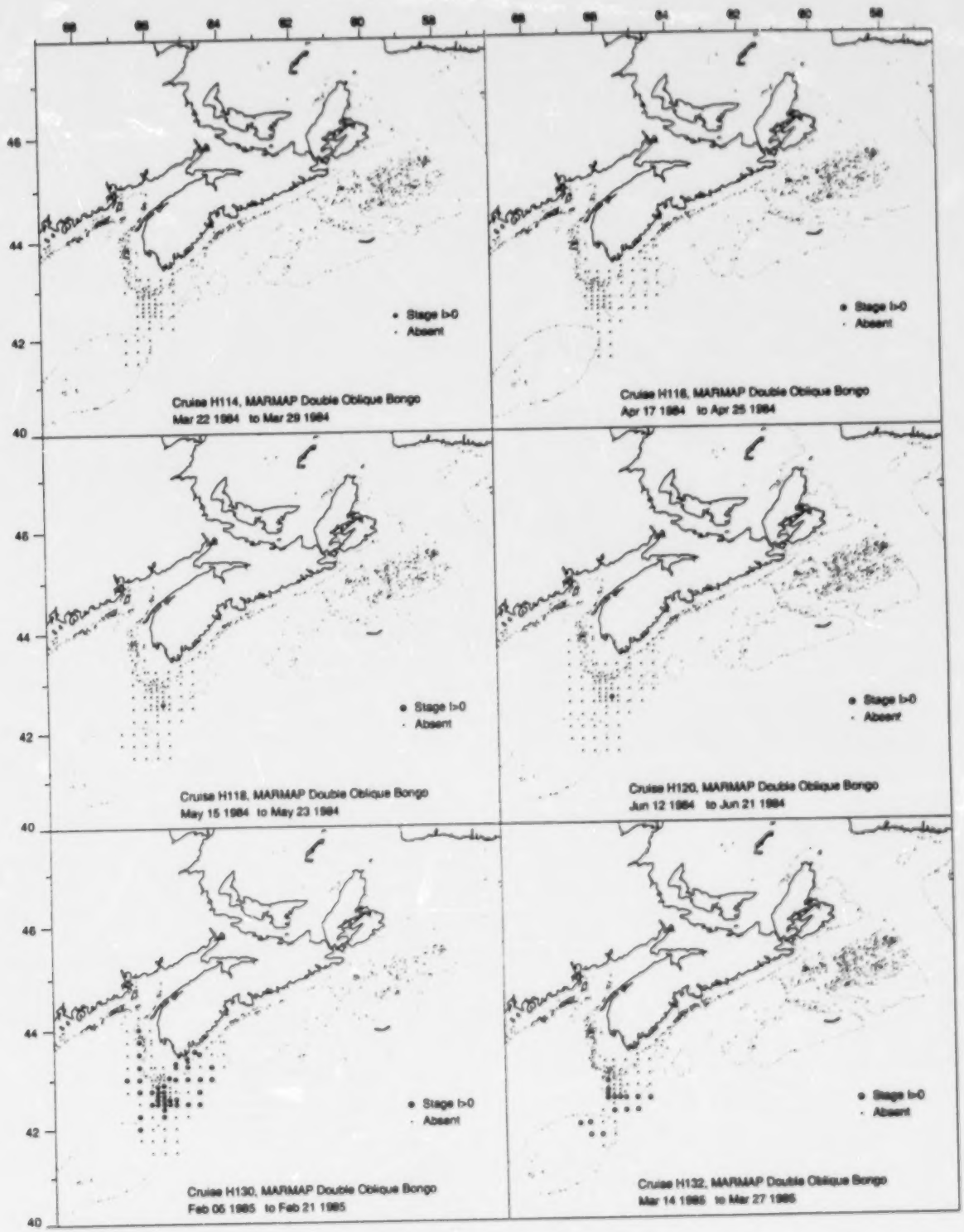
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Stage I>0
Absent
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Stage I>0
Absent
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Stage I>0
Absent
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Stage I>0
Absent
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Stage I>0
Absent
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985
Stage I>0
Absent

Fig. 8.3.1. (continued).

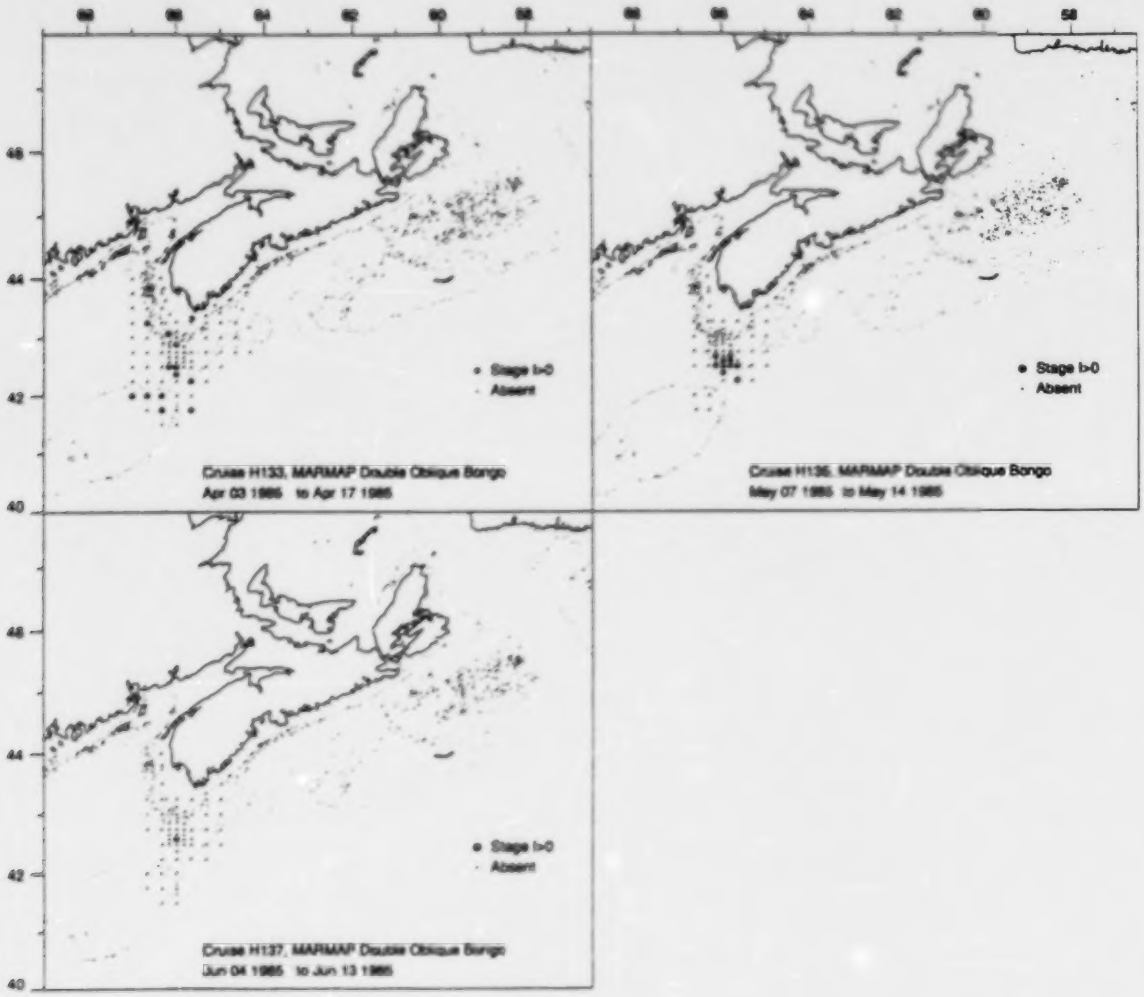
Stage I>0
Absent
Cruise H133, MARMAP Double Oblique Bongo
Apr 03 1985 to Apr 17 1985
Stage I>0
Absent
Cruise H135, MARMAP Double Oblique Bongo
May 07 1985 to May 14 1985
Stage I>0
Absent
Cruise H137, MARMAP Double Oblique Bongo
Jun 04 1985 to Jun 13 1985

Fig. 8.3.1. (continued).

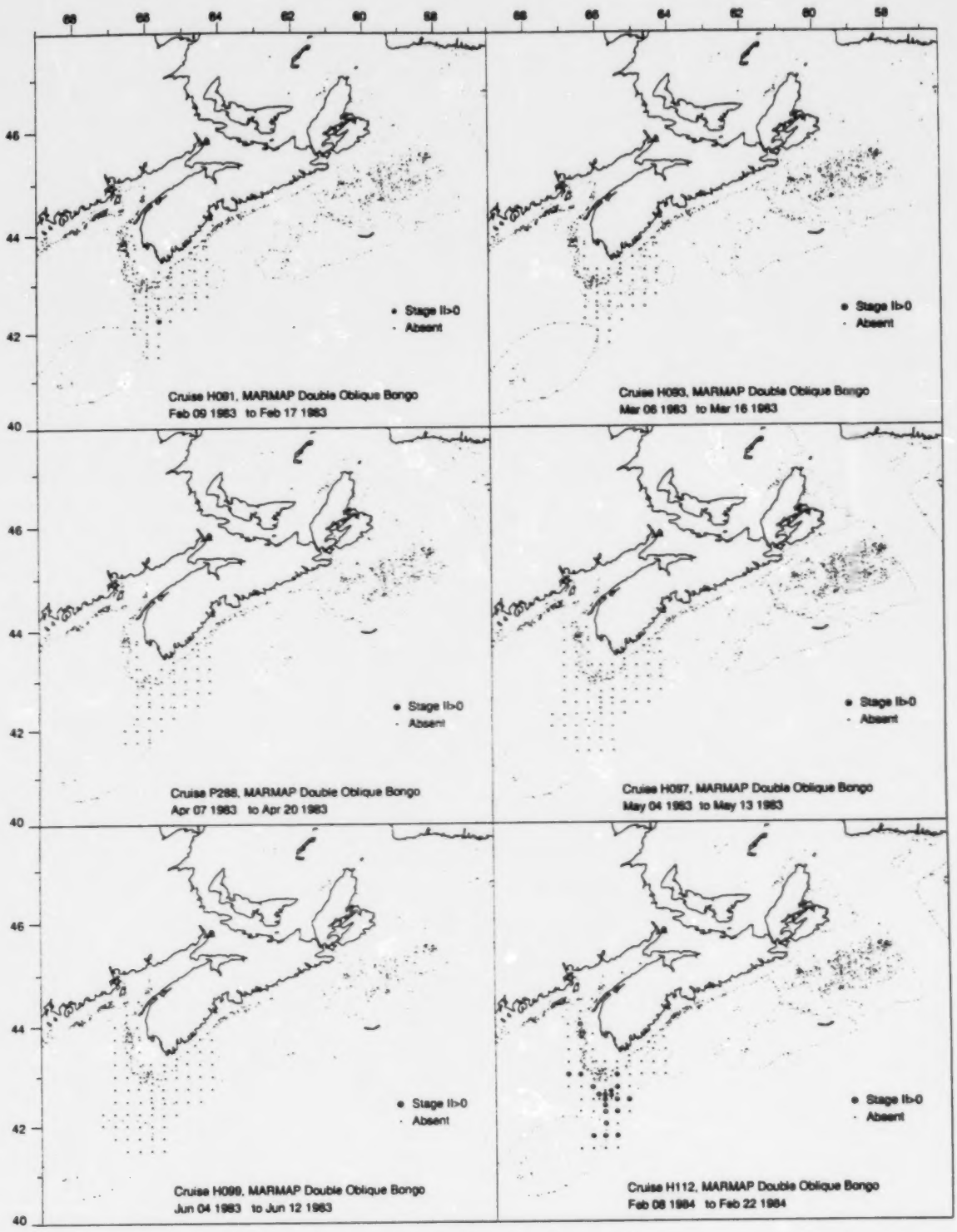
Stage II>0
Absent
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 06 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984

Fig. 8.3.2. Fisheries Ecology Program Cruises: Stage II pollock eggs.

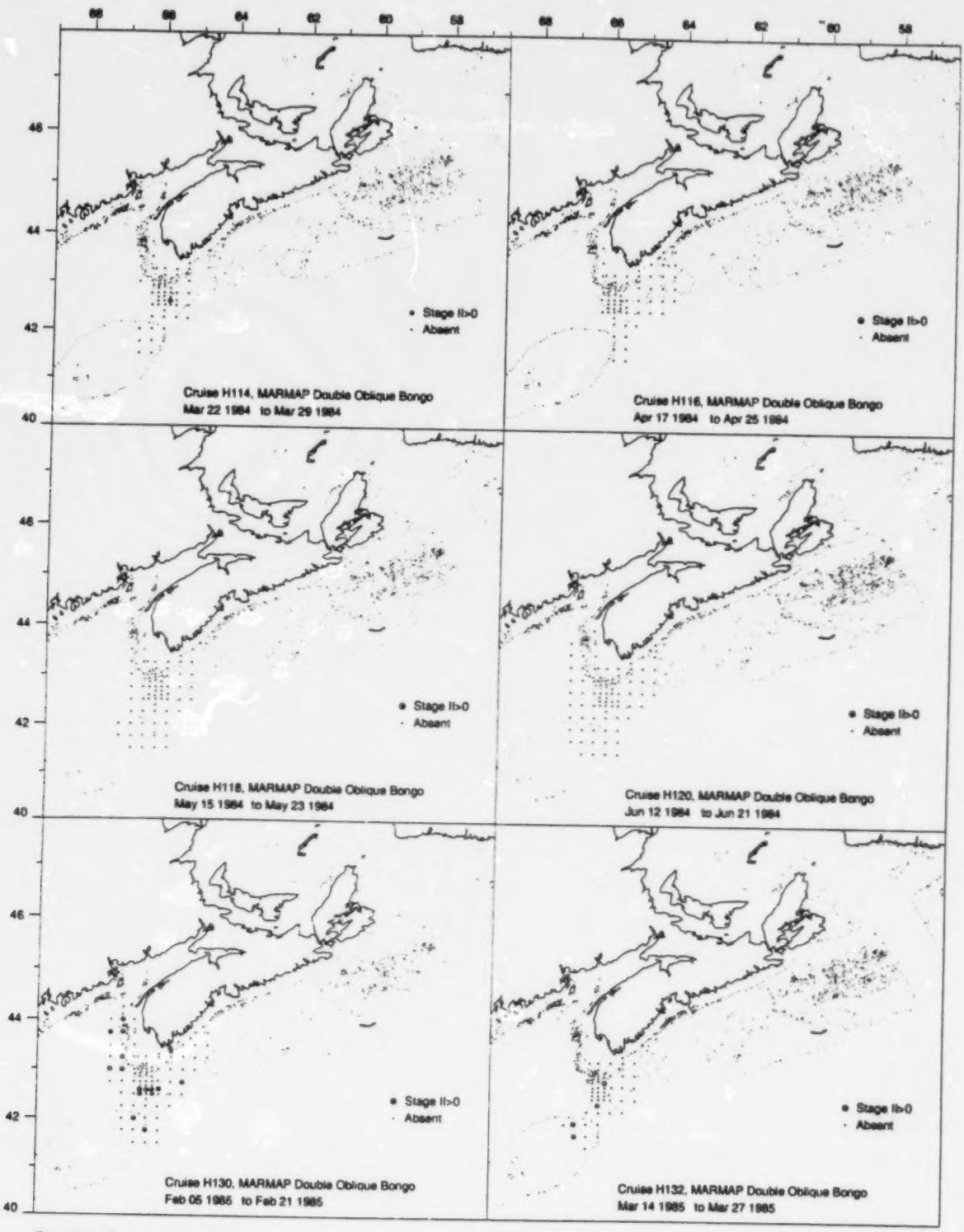
Stage IIb>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.2. (continued).

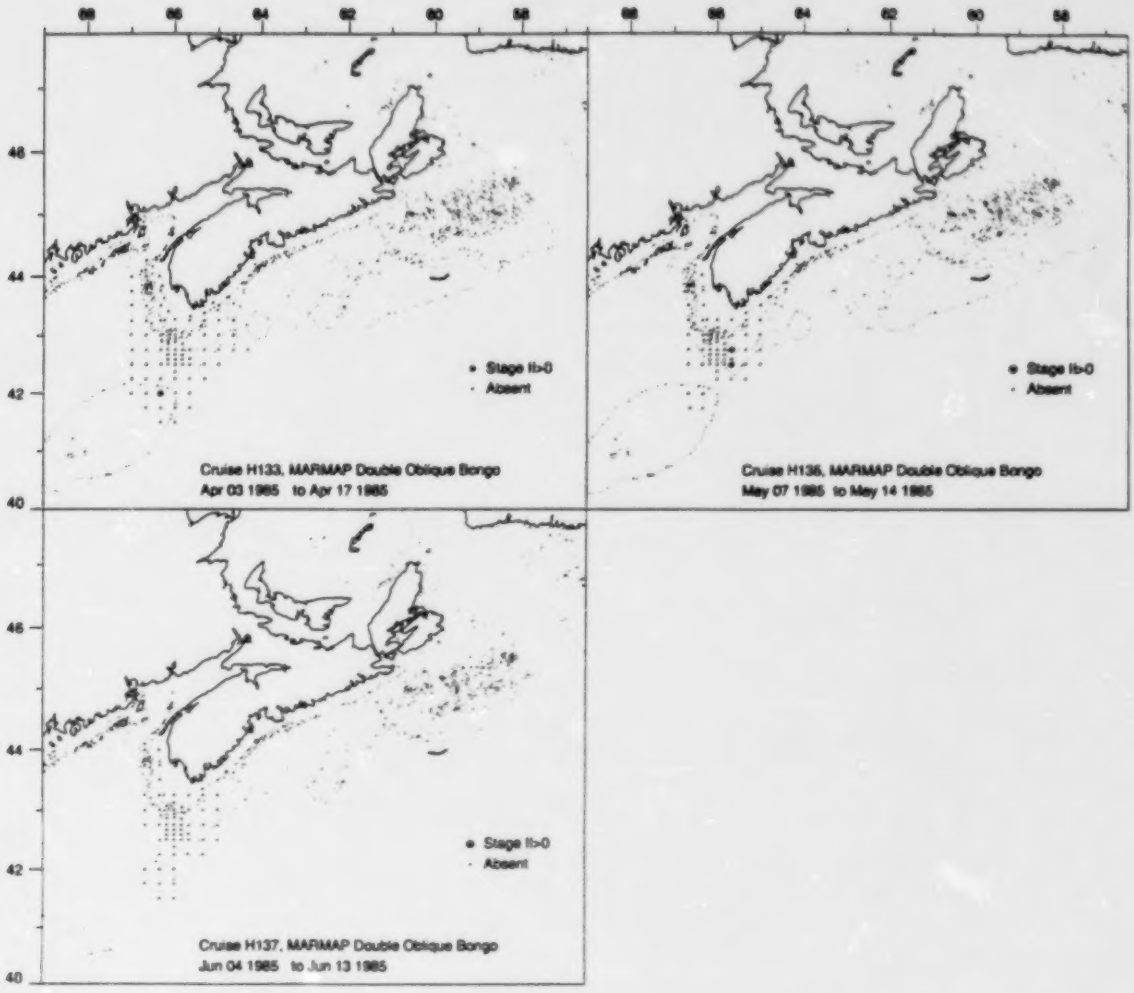
Stage II>0
Absent
Cruise H133, MARMAP Double Oblique Bongo
Apr 03 1985 to Apr 17 1985
Stage II>0
Absent
Cruise H135, MARMAP Double Oblique Bongo
May 07 1985 to May 14 1985
Stage II>0
Absent
Cruise H137, MARMAP Double Oblique Bongo
Jun 04 1985 to Jun 13 1985

Fig. 8.3.2. (continued).

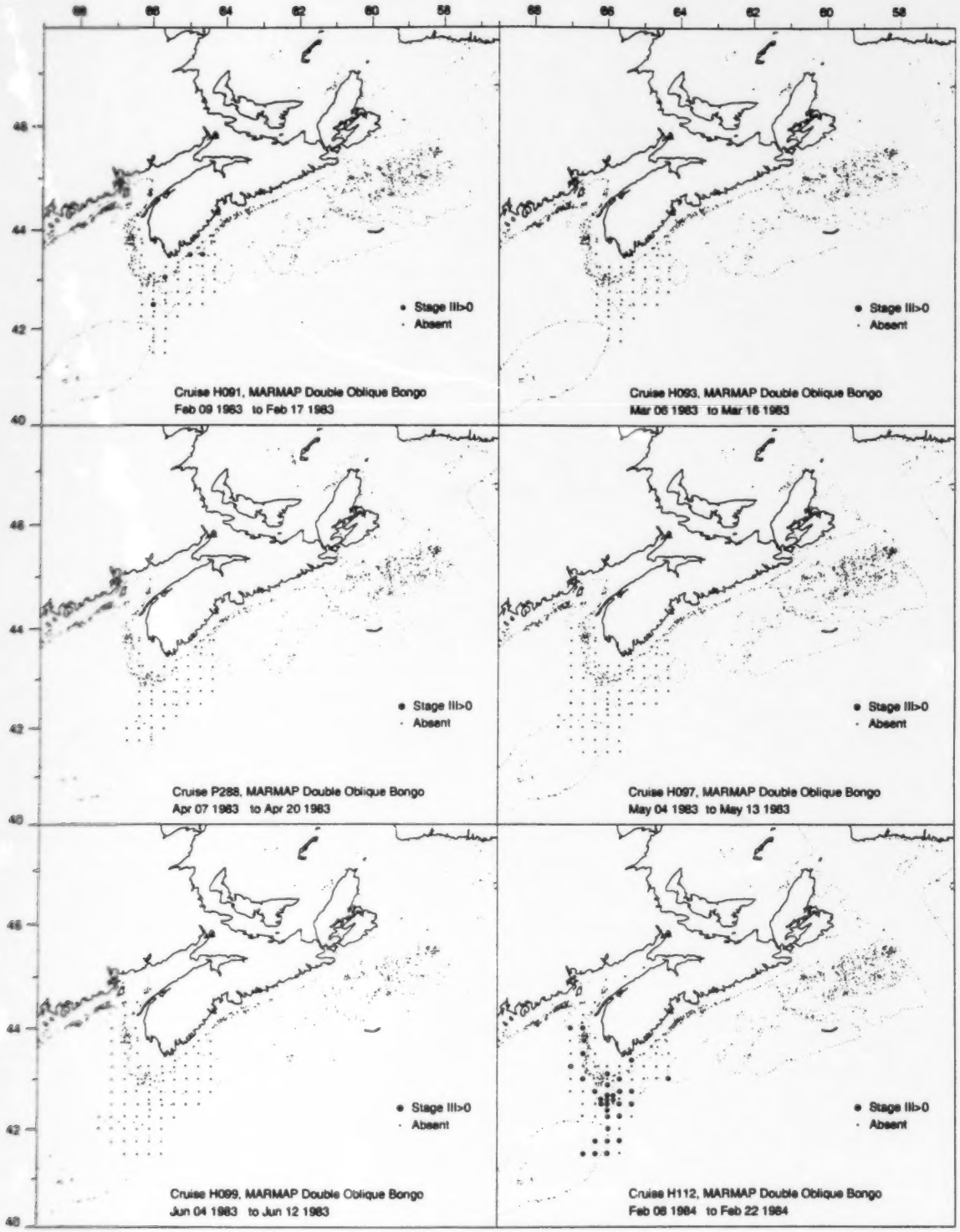

Fig. 8.3.3. Fisheries Ecology Program Cruises: Stage III pollock eggs.

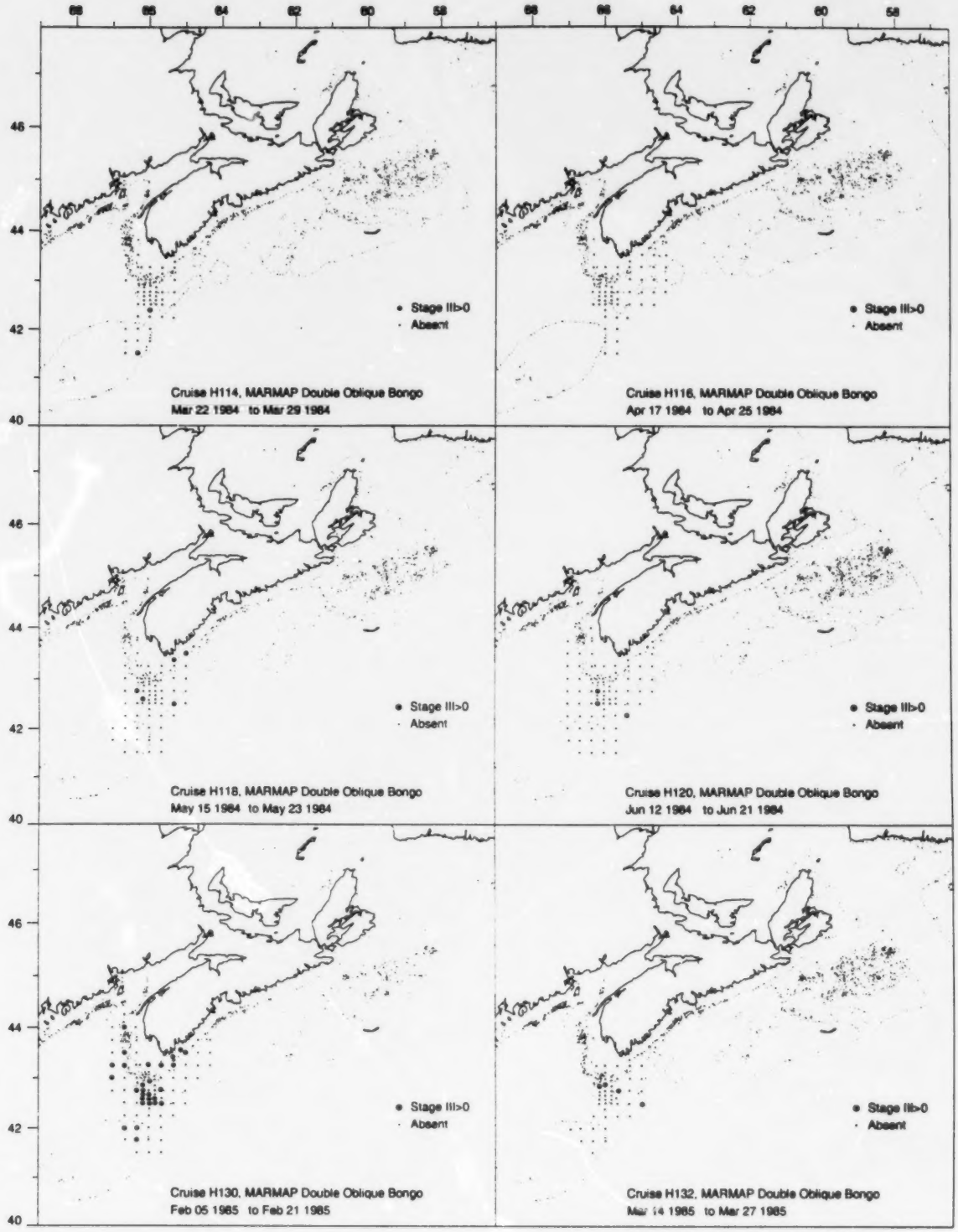
Stage IIIb>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.3. (continued).

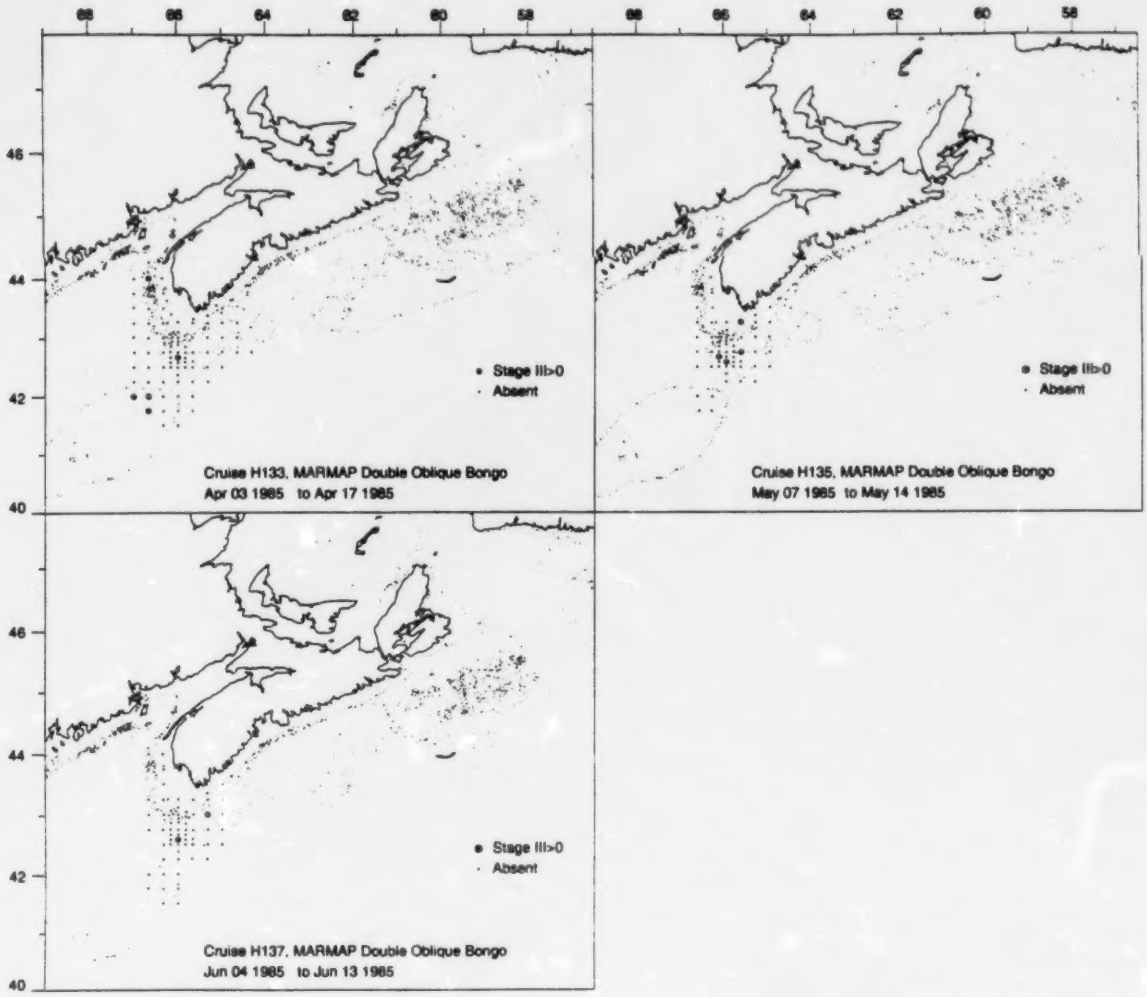

Fig. 8.3.3. (continued).

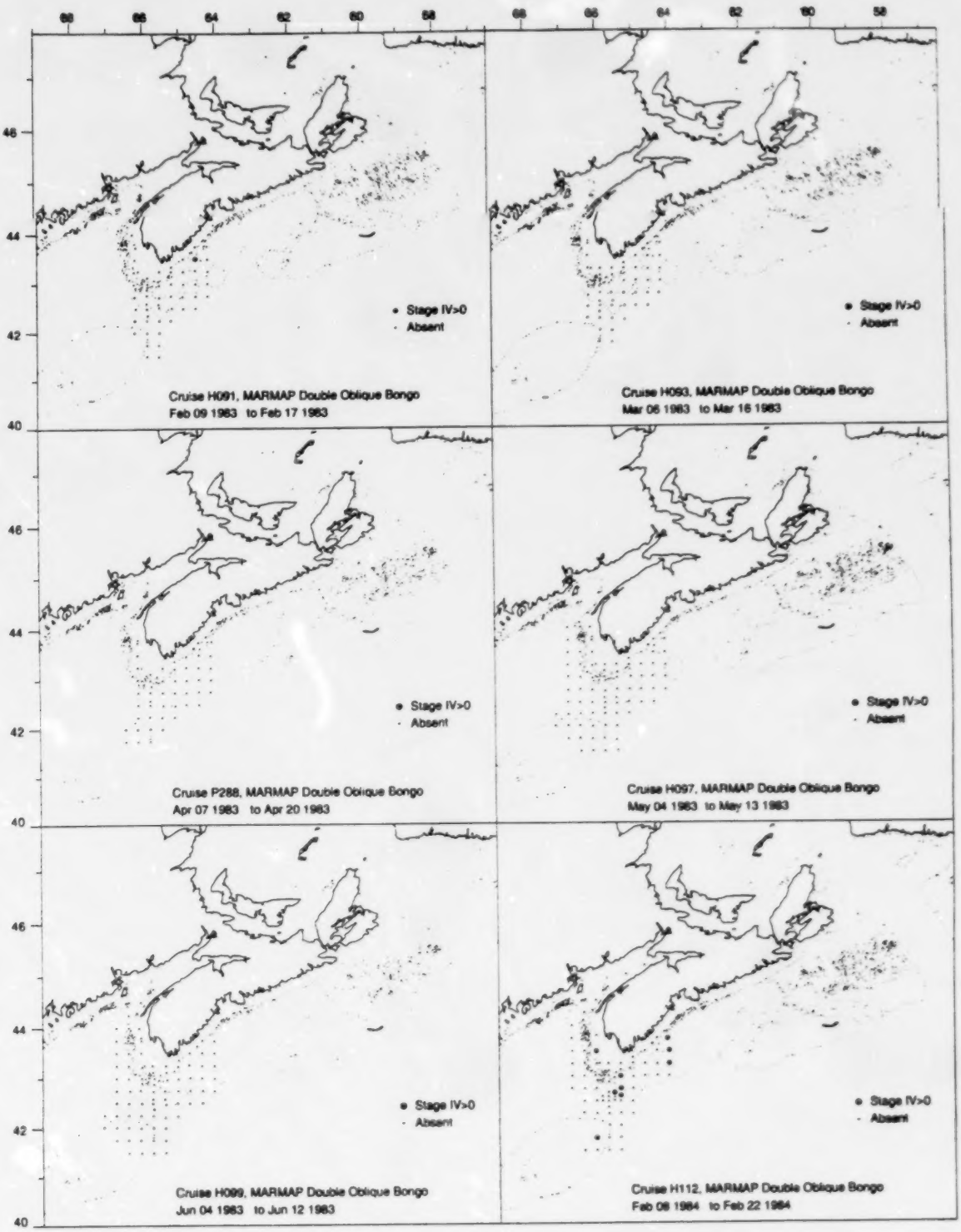

Fig. 8.3.4. Fisheries Ecology Program Cruises: Stage IV pollock eggs.

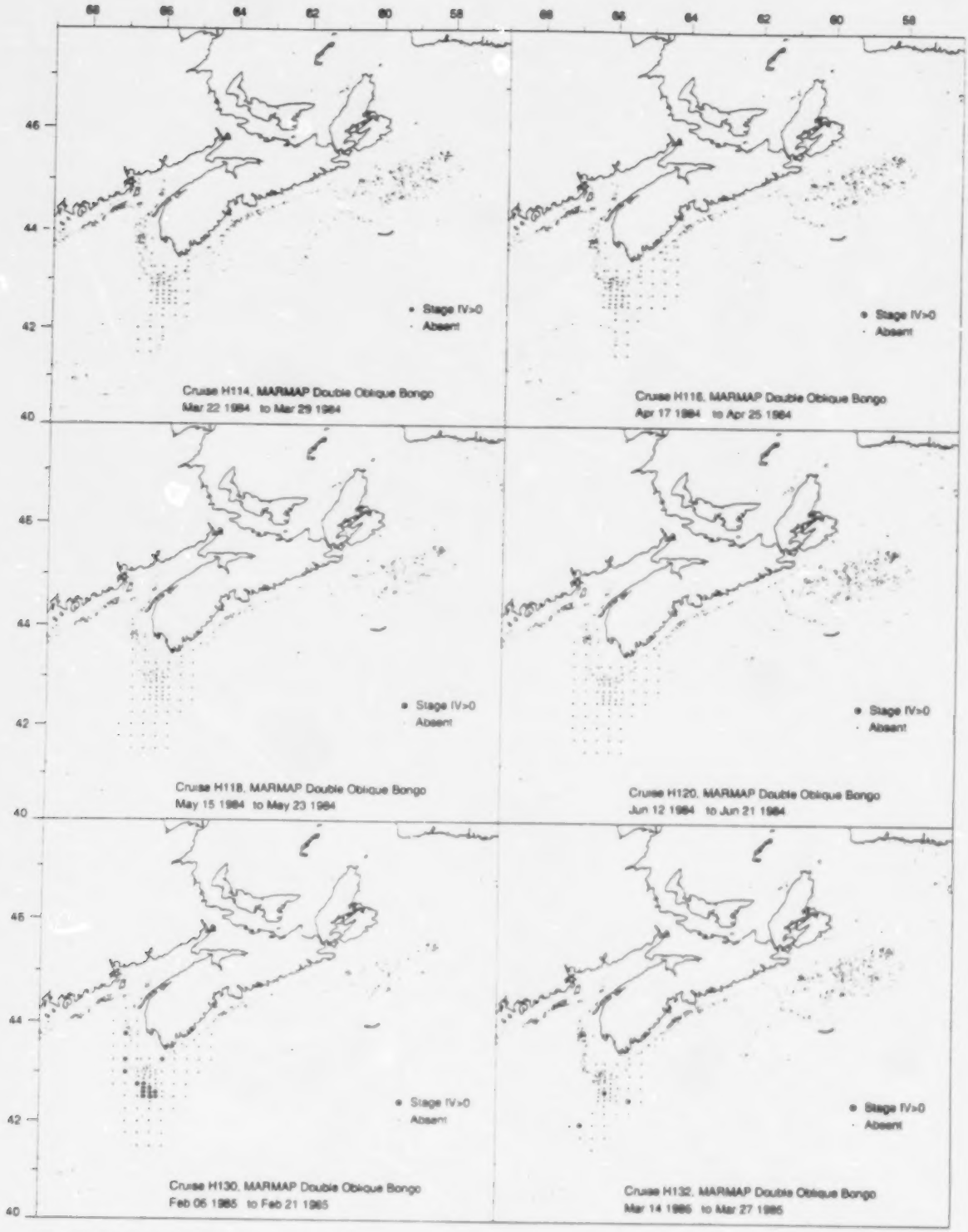
Stage IV>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 06 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.4. (continued).

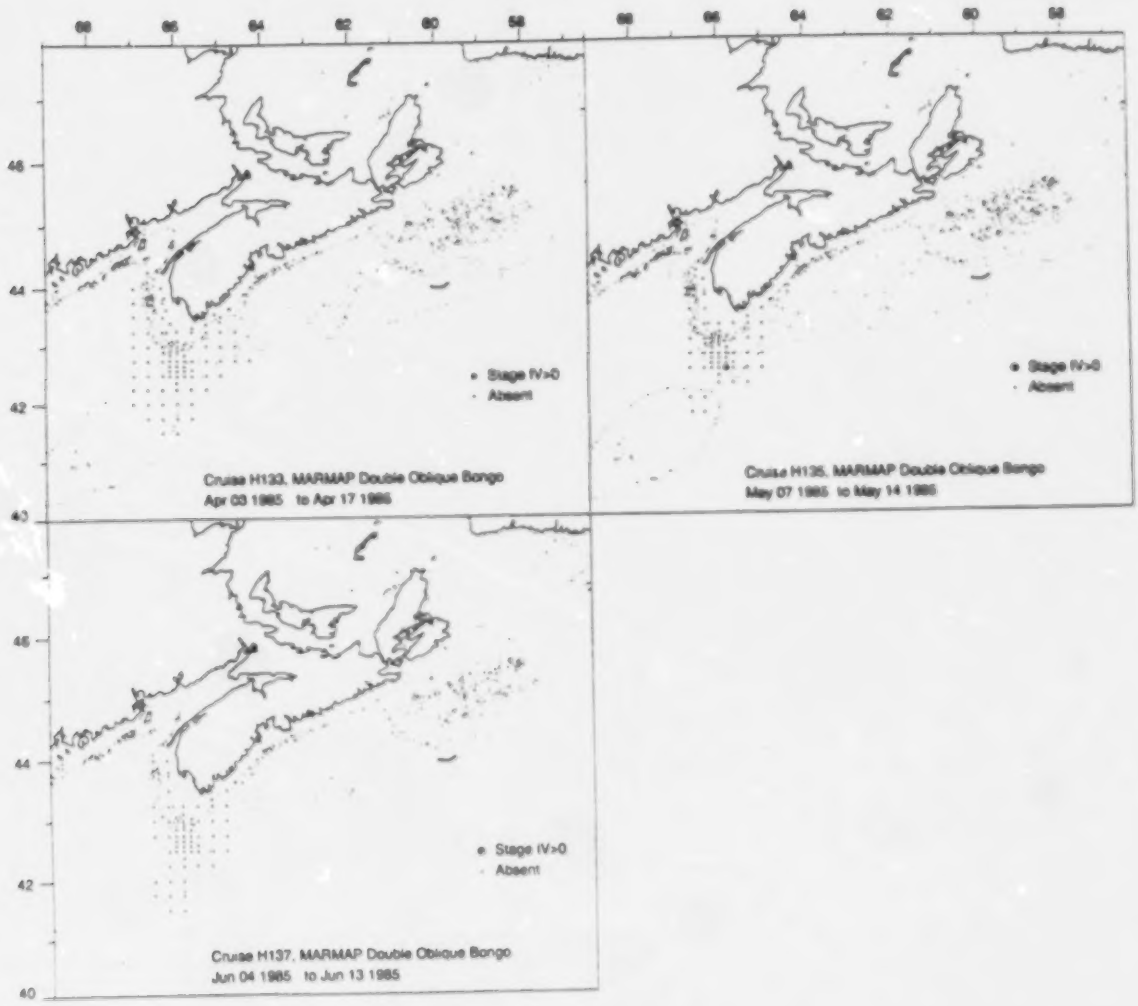

Fig. 8.3.4. (continued).

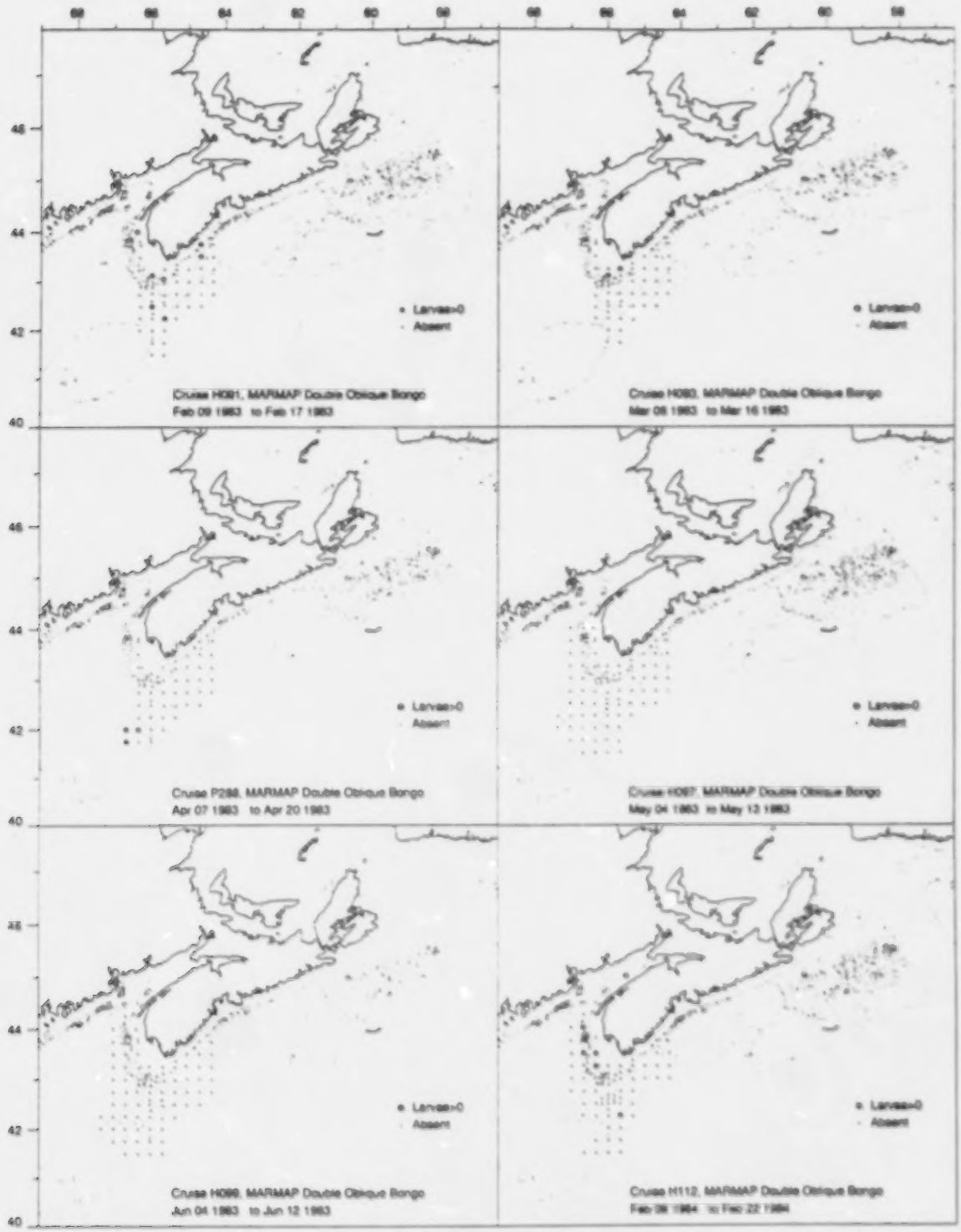
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 05 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 09 1984 to Feb 22 1984
Larvae>0
Absent

Fig. 8.3.5. Fisheries Ecology Program Cruises: Pollock larvae (1-7mm).

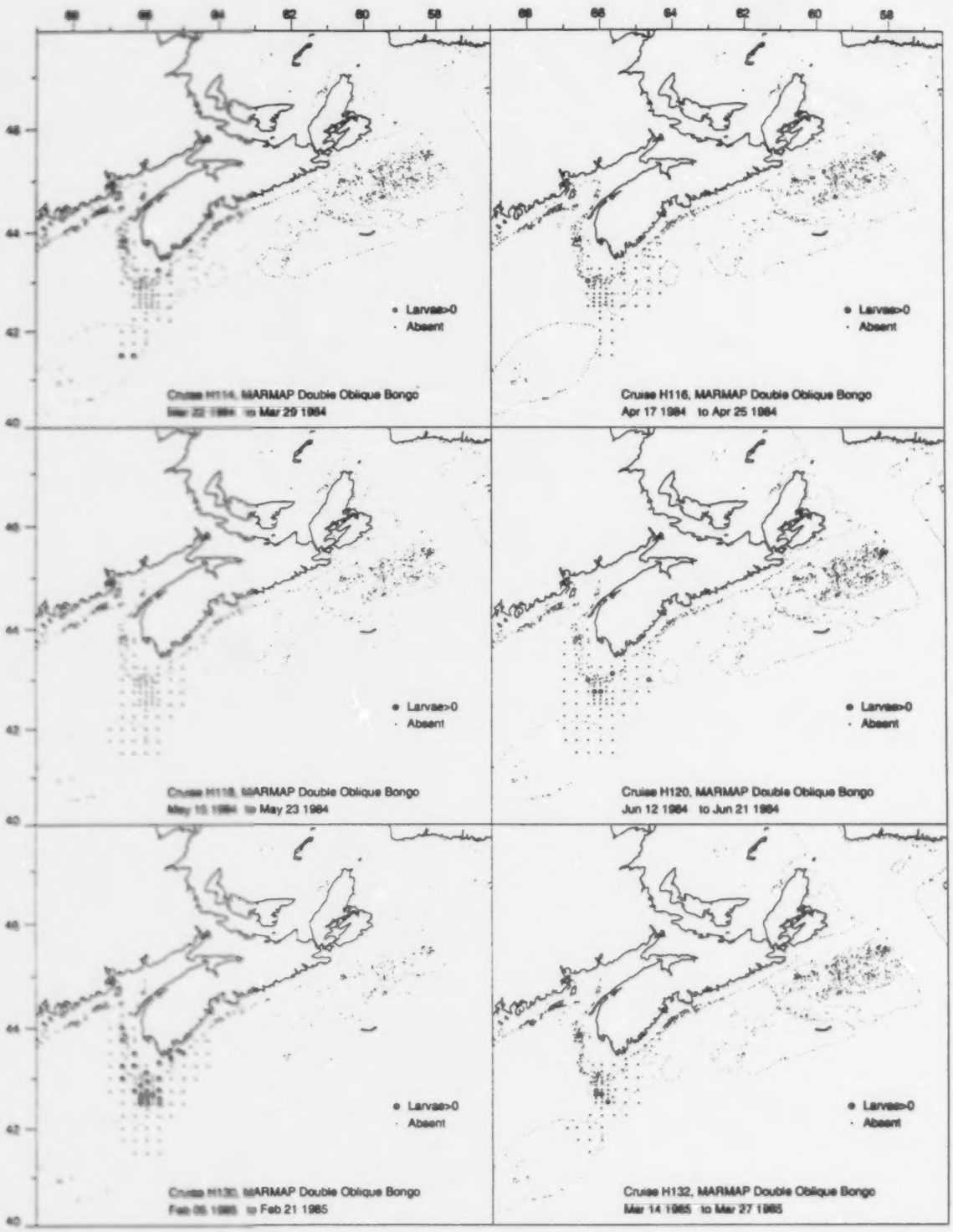
Larvae>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H116, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 10 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 05 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
Mar 14 1985 to Mar 27 1985

Fig. 8.3.5. (continued).

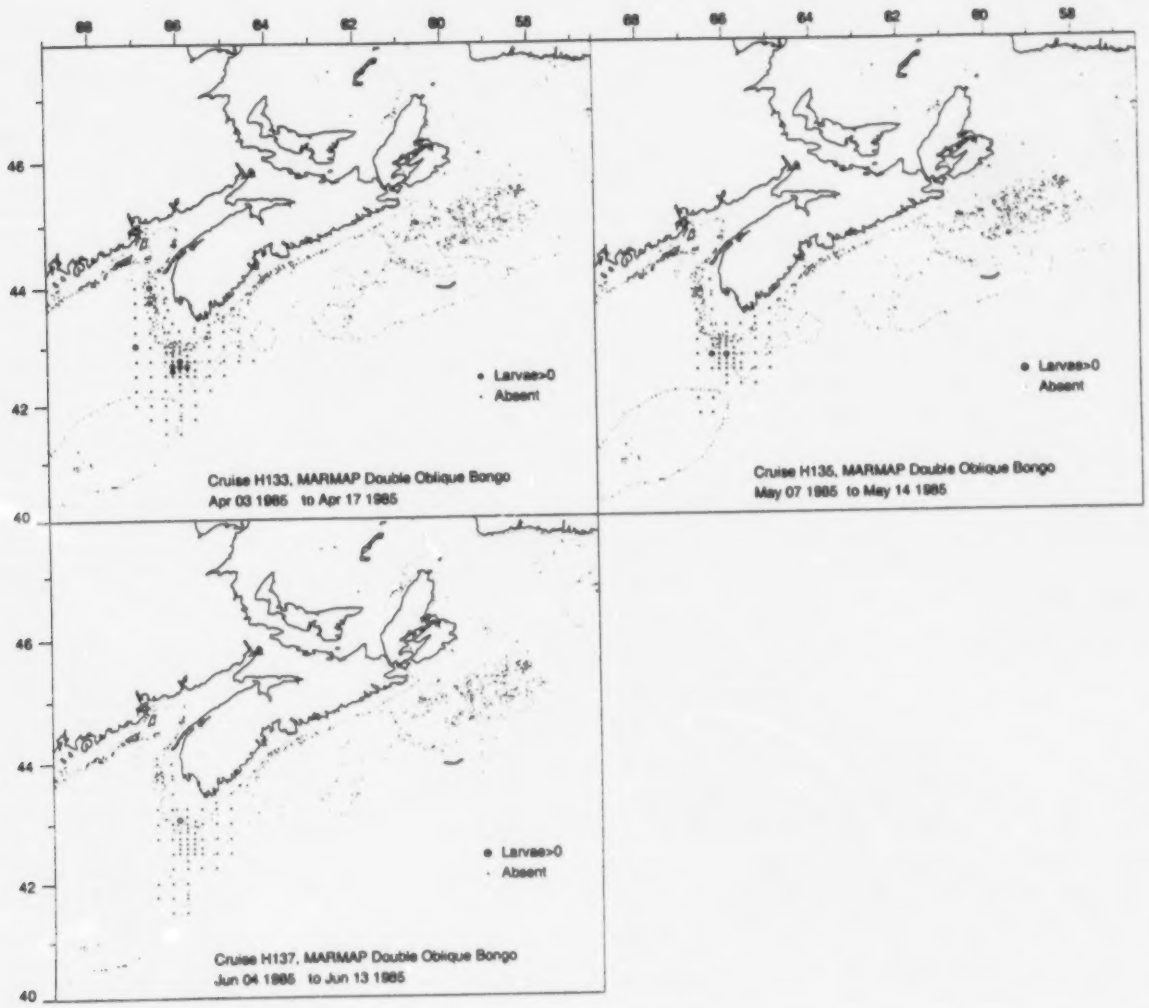

Fig. 8.3.5. (continued).

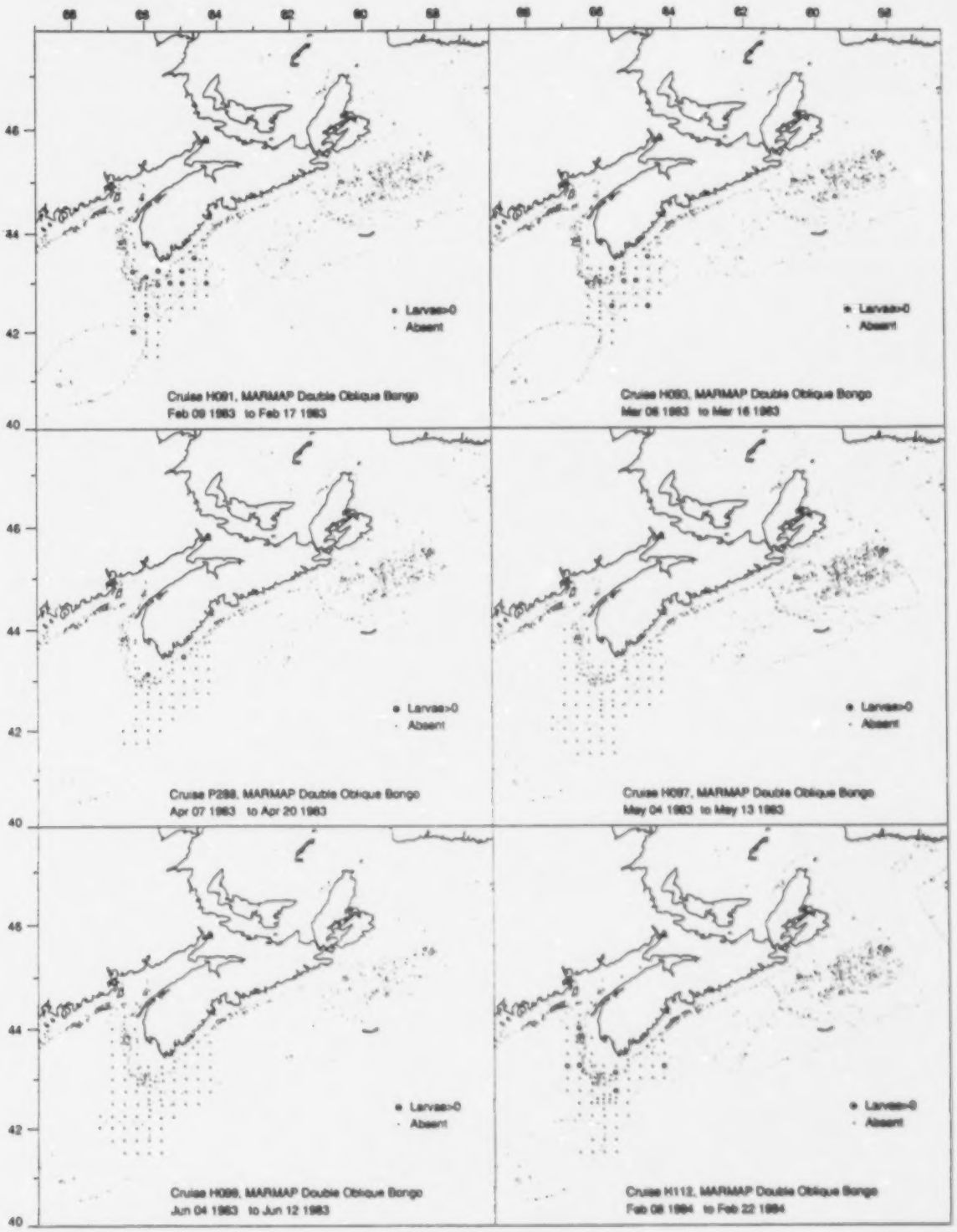
Cruise H091, MARMAP Double Oblique Bongo
Feb 09 1983 to Feb 17 1983
Cruise H093, MARMAP Double Oblique Bongo
Mar 08 1983 to Mar 16 1983
Cruise P288, MARMAP Double Oblique Bongo
Apr 07 1983 to Apr 20 1983
Cruise H097, MARMAP Double Oblique Bongo
May 04 1983 to May 13 1983
Cruise H099, MARMAP Double Oblique Bongo
Jun 04 1983 to Jun 12 1983
Cruise H112, MARMAP Double Oblique Bongo
Feb 08 1984 to Feb 22 1984
Larvae>0
Absent

Fig. 8.3.6. Fisheries Ecology Program Cruises: Pollock larvae (7+mm).

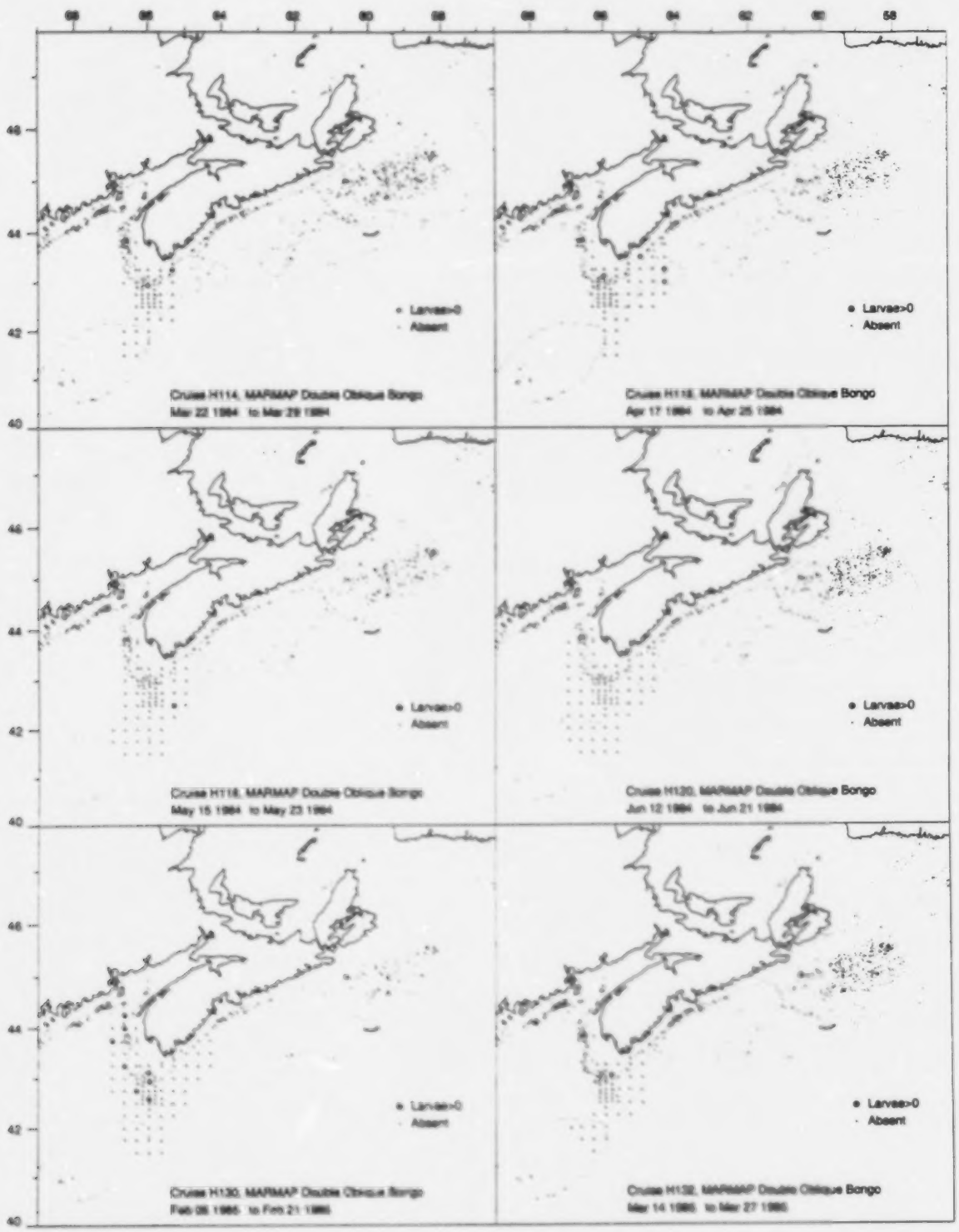
Larvae>0
Absent
Cruise H114, MARMAP Double Oblique Bongo
Mar 22 1984 to Mar 29 1984
Cruise H118, MARMAP Double Oblique Bongo
Apr 17 1984 to Apr 25 1984
Cruise H118, MARMAP Double Oblique Bongo
May 15 1984 to May 23 1984
Cruise H120, MARMAP Double Oblique Bongo
Jun 12 1984 to Jun 21 1984
Cruise H130, MARMAP Double Oblique Bongo
Feb 08 1985 to Feb 21 1985
Cruise H132, MARMAP Double Oblique Bongo
May 14 1985 to May 27 1985

Fig. 8.3.6. (continued).

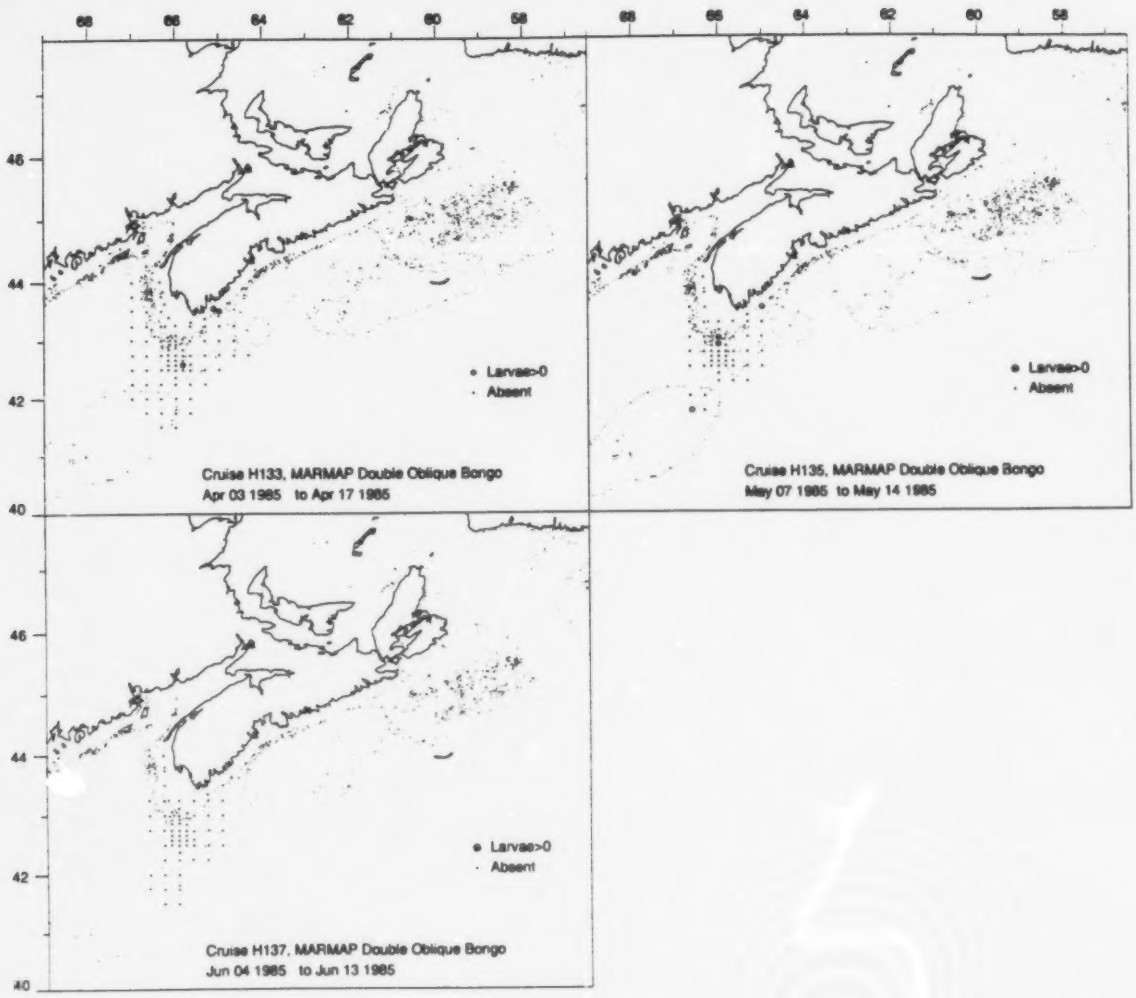

Fig. 8.3.6. (continued).

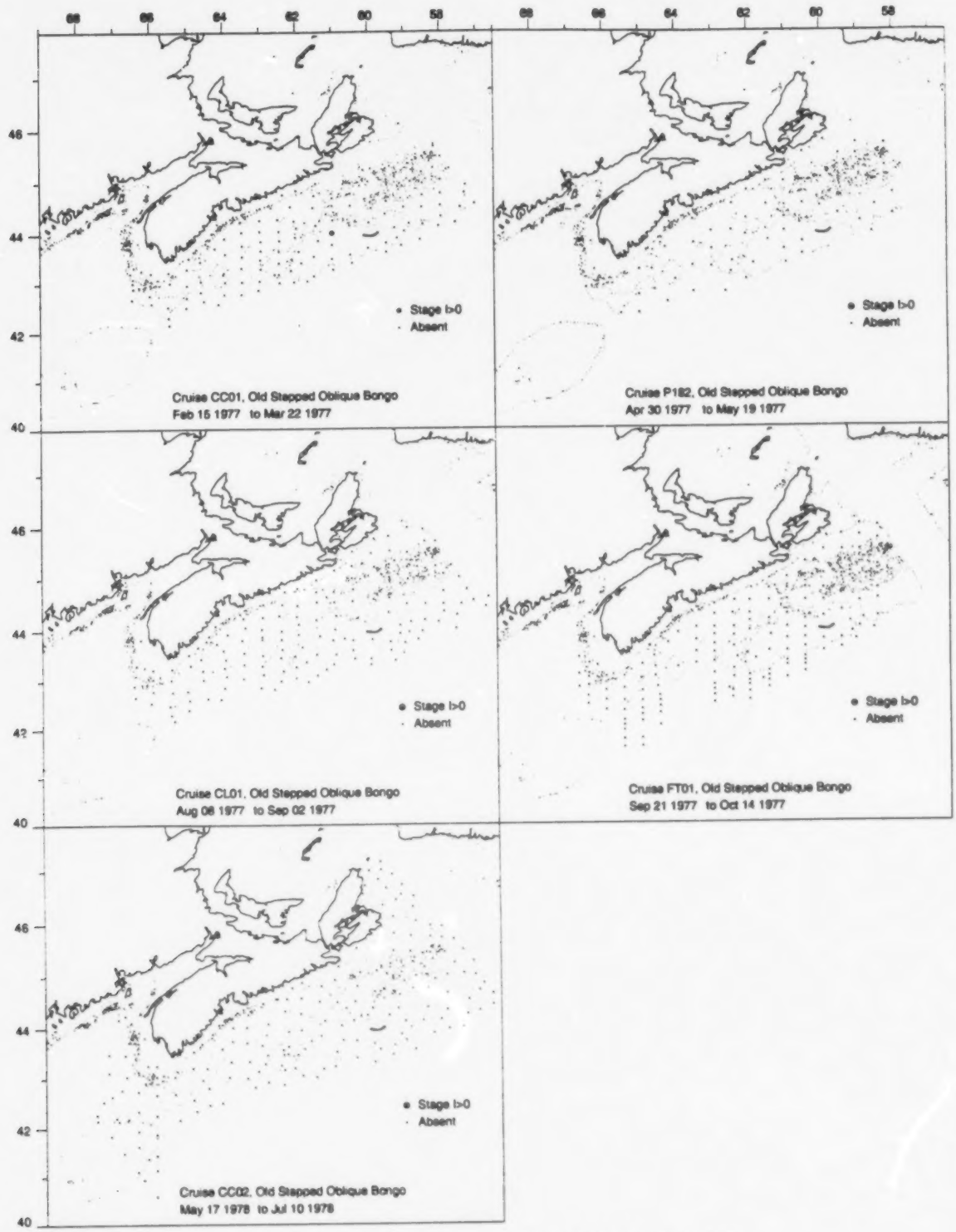
Stage I>0
Absent
Cruise CC01, Old Stepped Oblique Bongo
Feb 15 1977 to Mar 22 1977
Cruise P182, Old Stepped Oblique Bongo
Apr 30 1977 to May 19 1977
Cruise CL01, Old Stepped Oblique Bongo
Aug 06 1977 to Sep 02 1977
Cruise FT01, Old Stepped Oblique Bongo
Sep 21 1977 to Oct 14 1977
Cruise CC02, Old Stepped Oblique Bongo
May 17 1978 to Jul 10 1978

Fig. 8.4.1. Scotian Shelf Ichthyoplankton Program Cruises: Stage I pollock eggs.

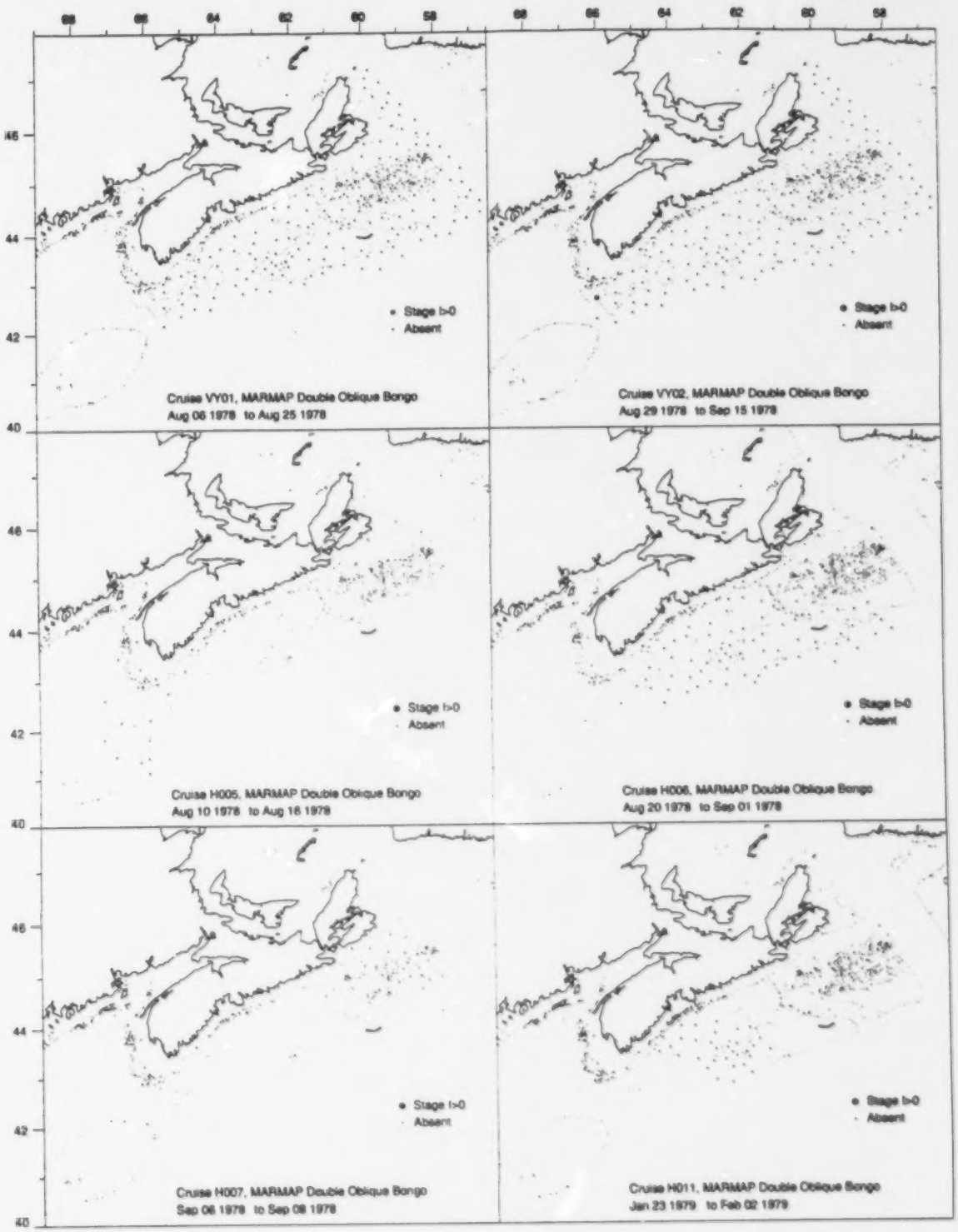
Stage I>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.1. (continued).

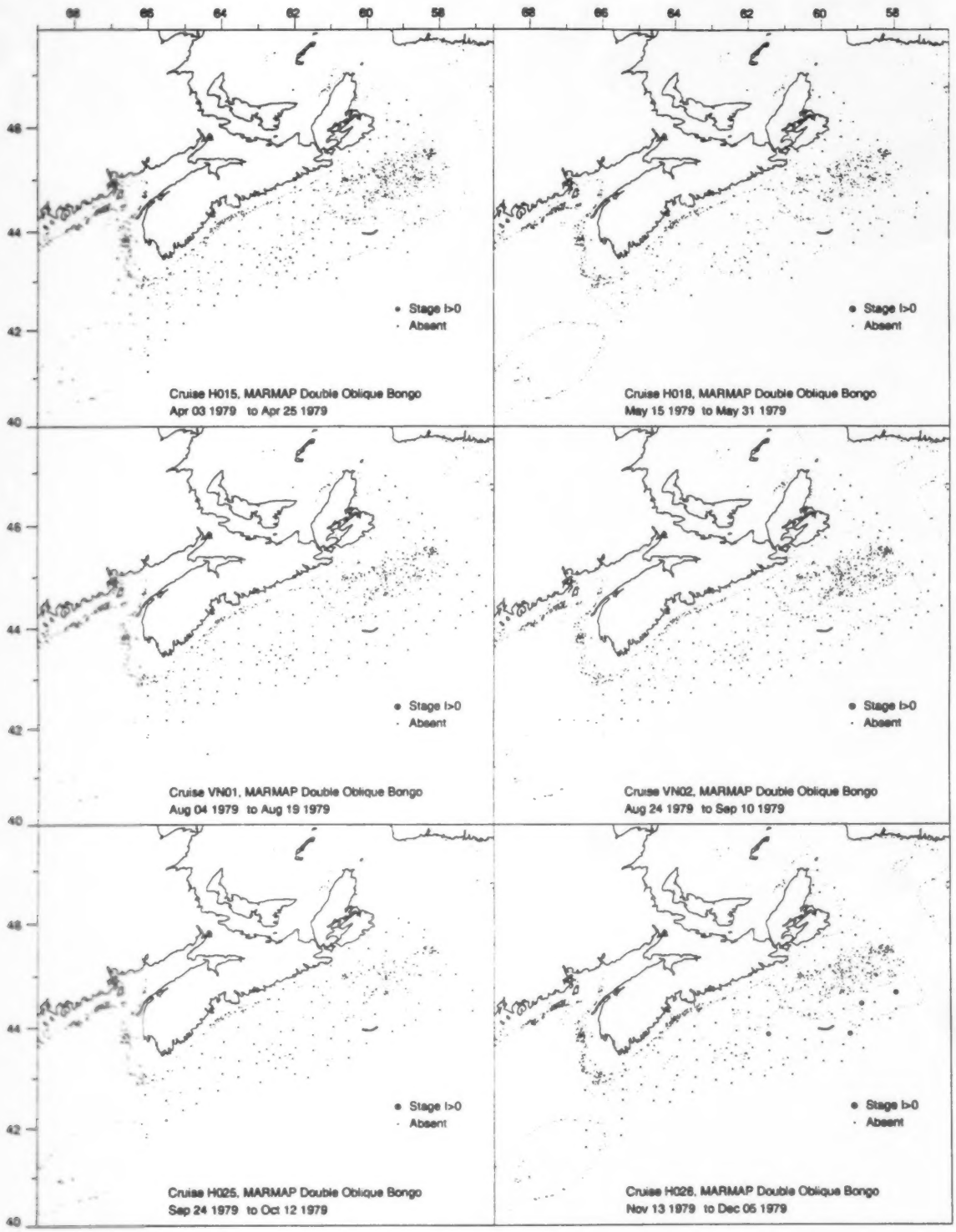

Fig. 8.4.1. (continued).

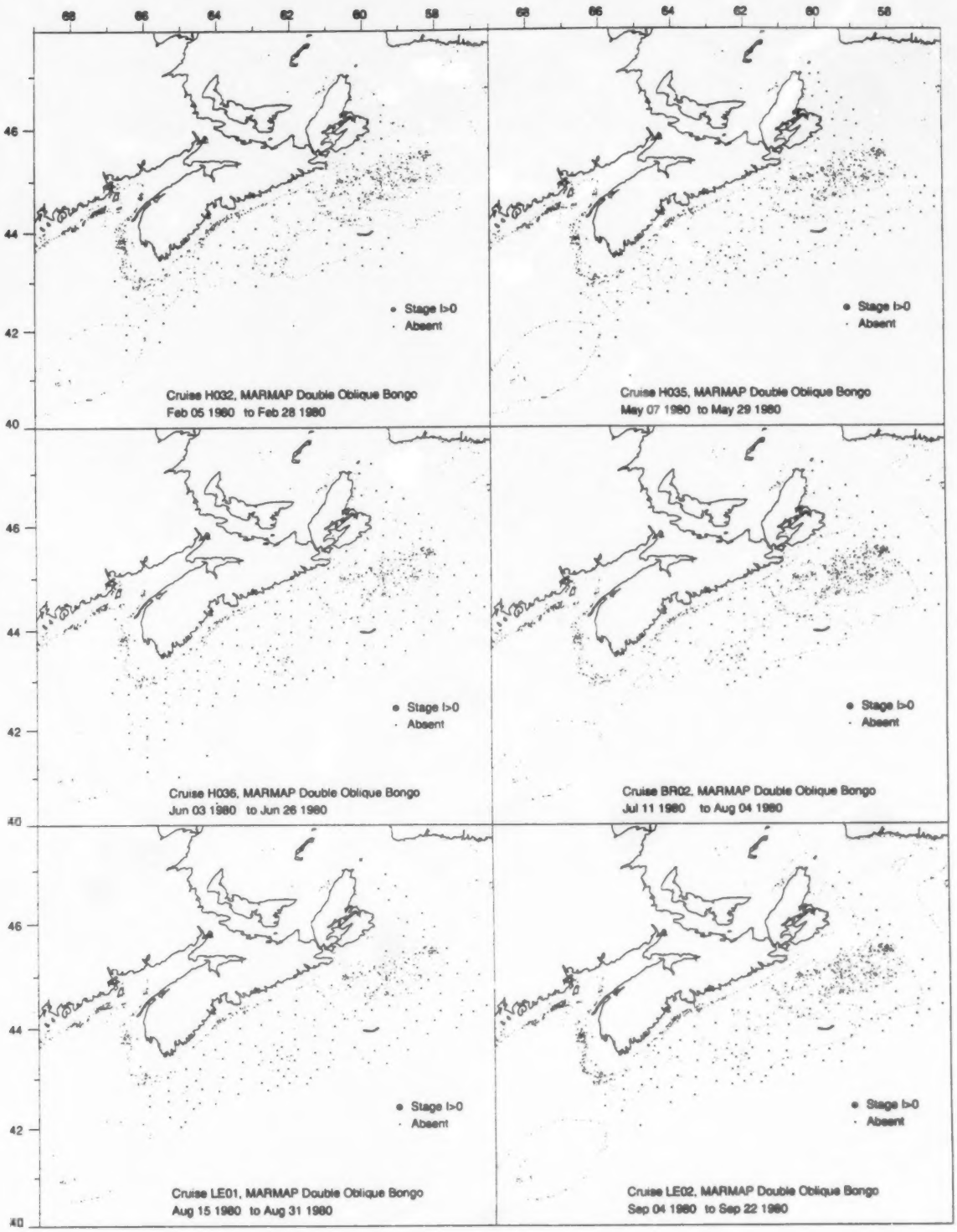

Fig. 8.4.1. (continued).

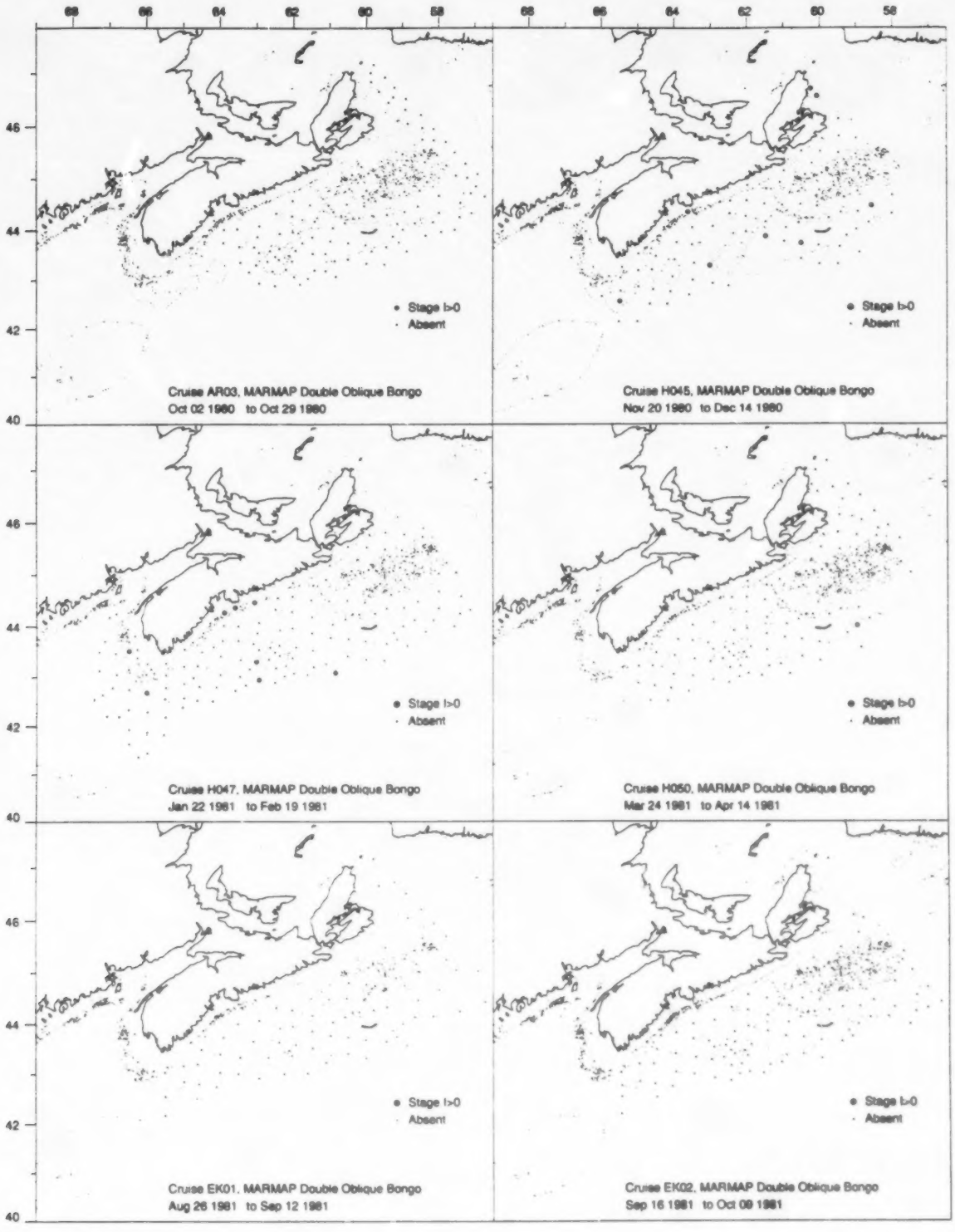

Fig. 8.4.1. (continued).

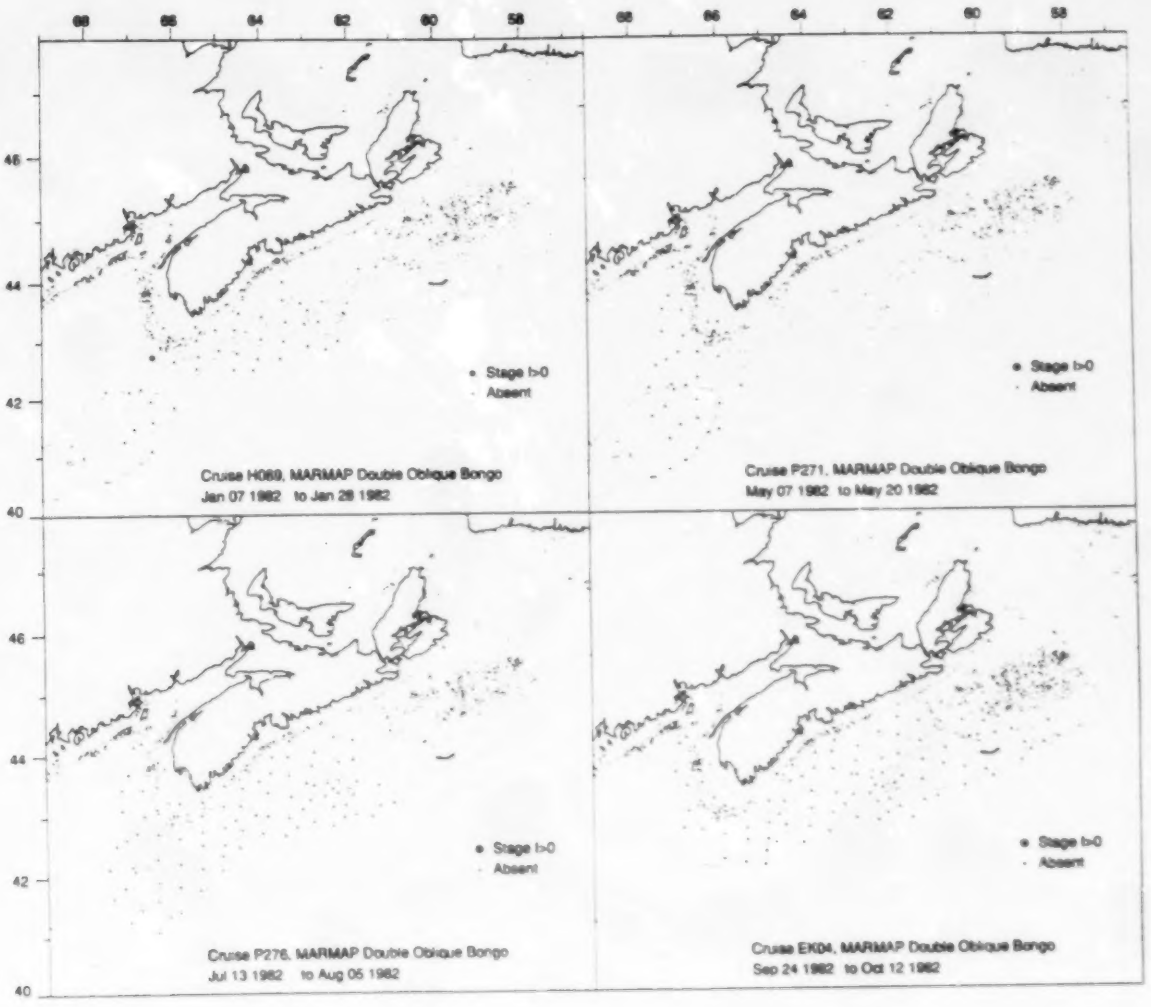

Fig. 8.4.1. (continued).

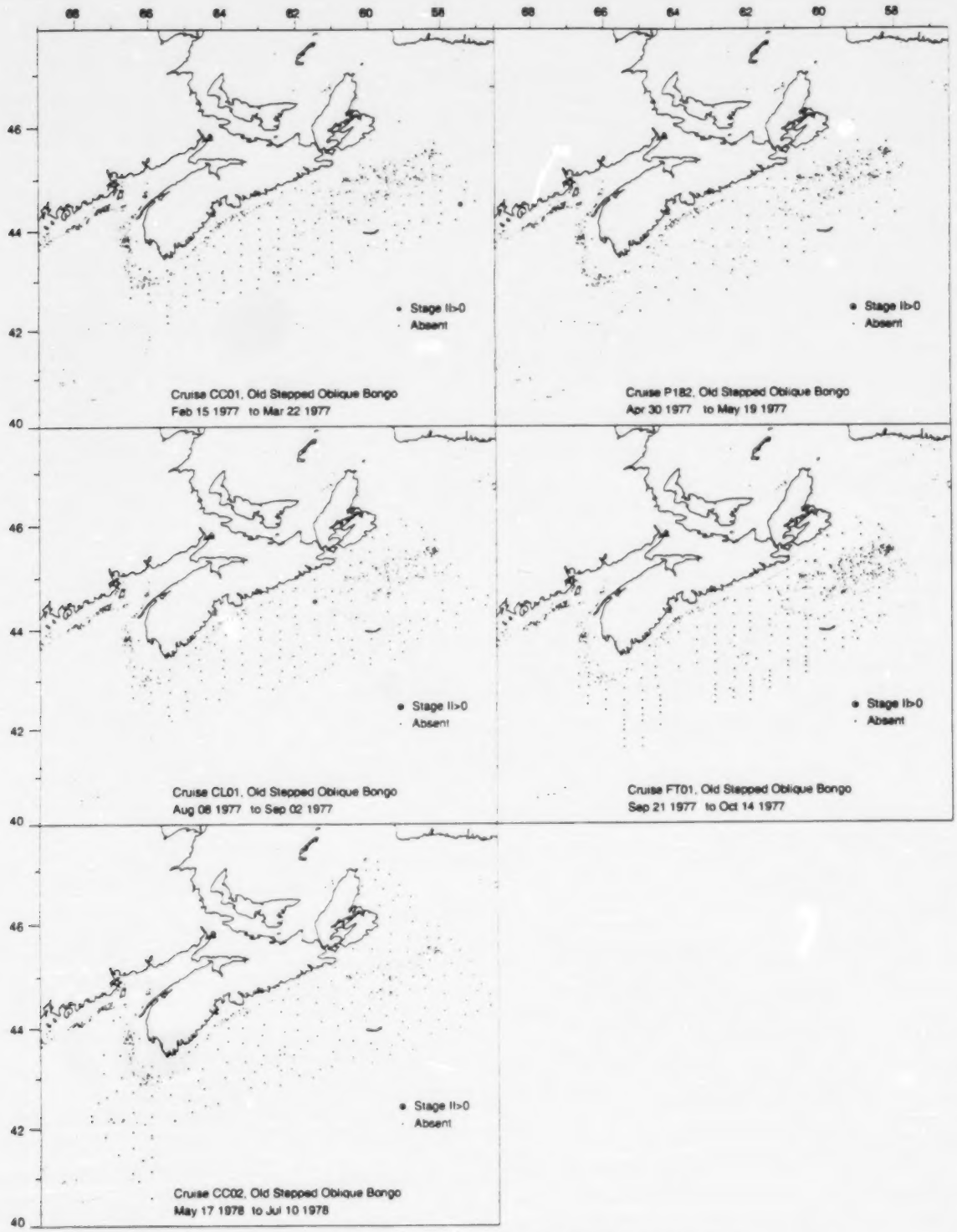

Fig. 8.4.2. Scotian Shelf Ichthyoplankton Program Cruises: Stage II pollock eggs.

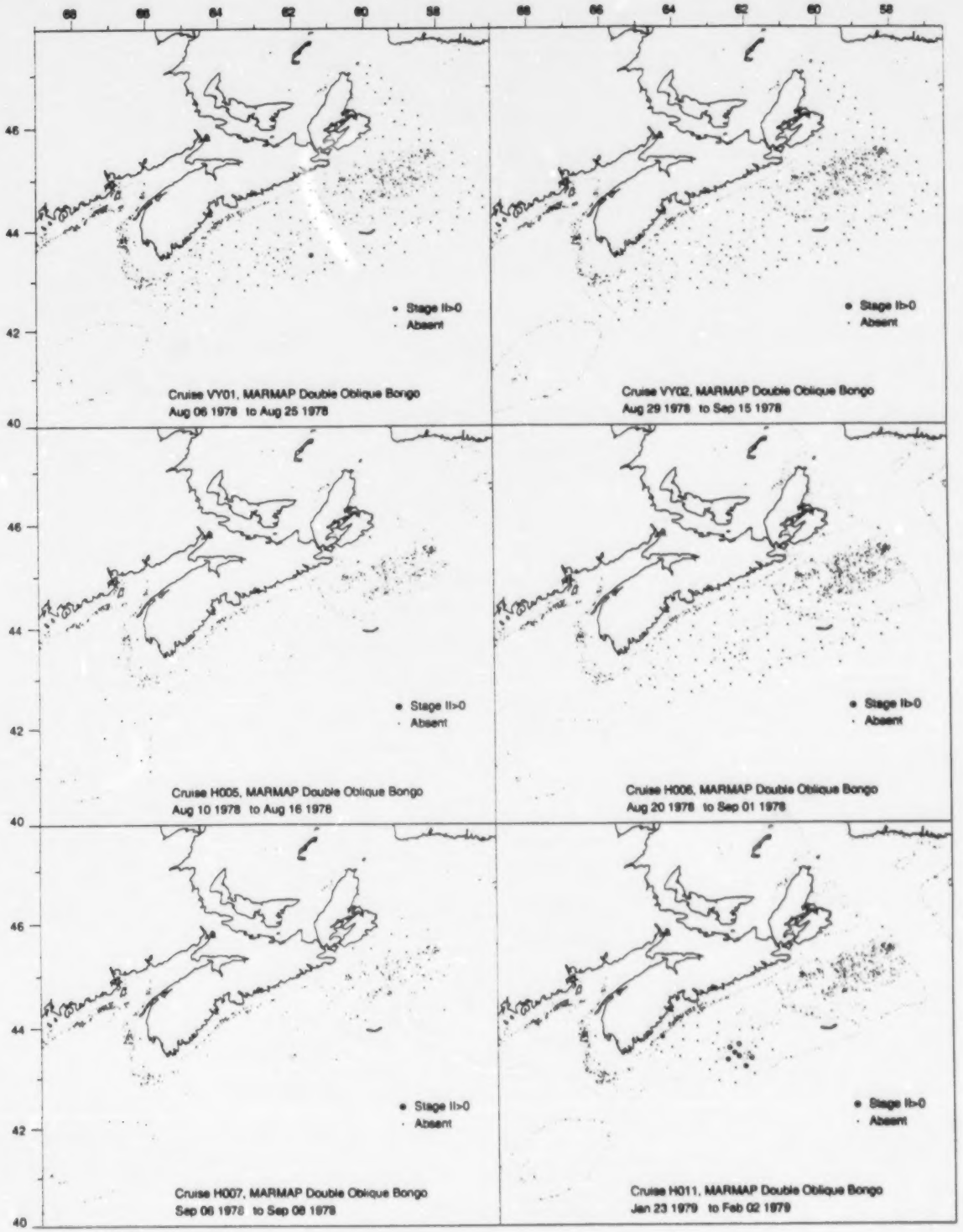
66
64
62
60
58
46
44
42
40
• Stage II>0
· Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.2. (continued).

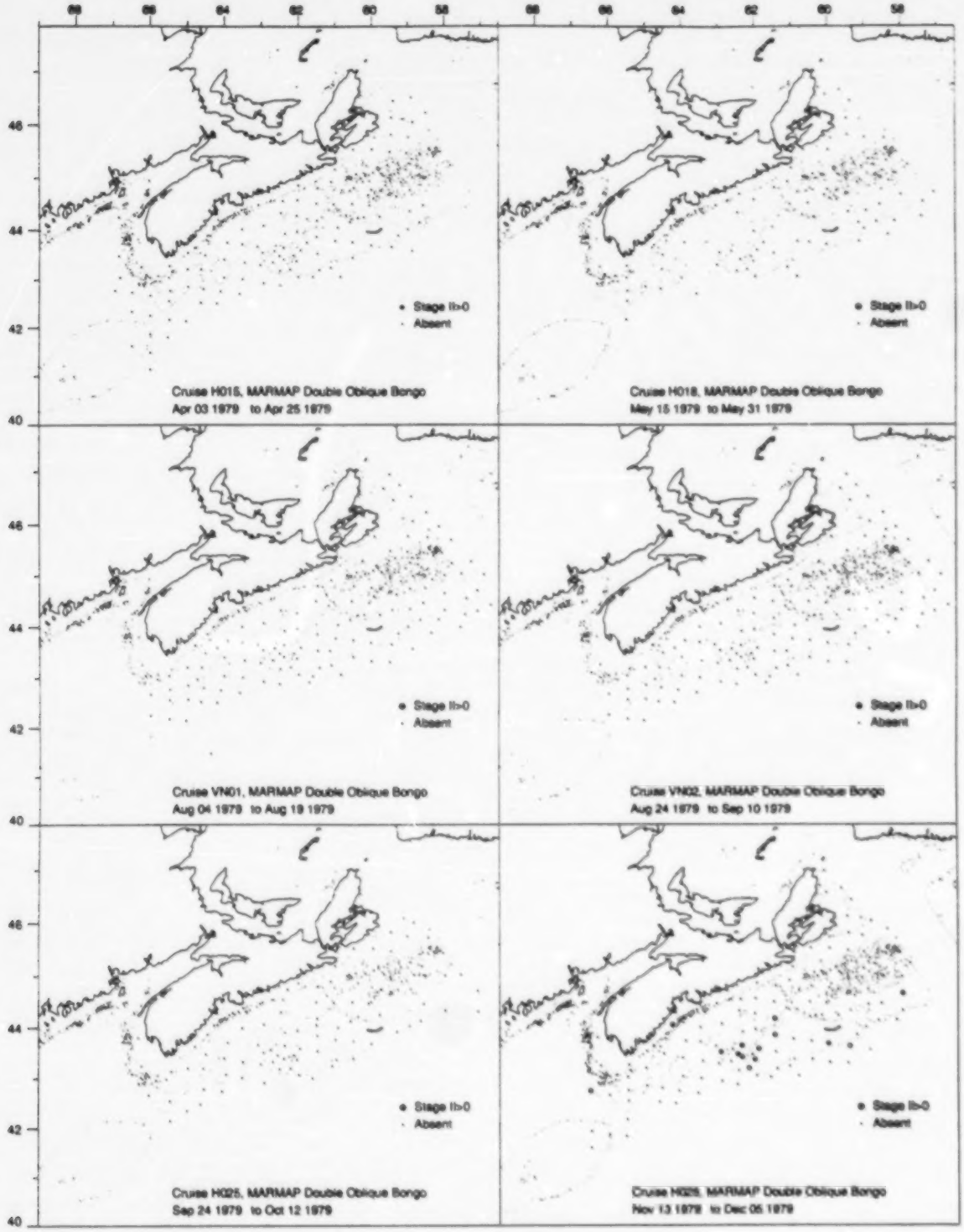
Stage II>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H025, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.2. (continued).

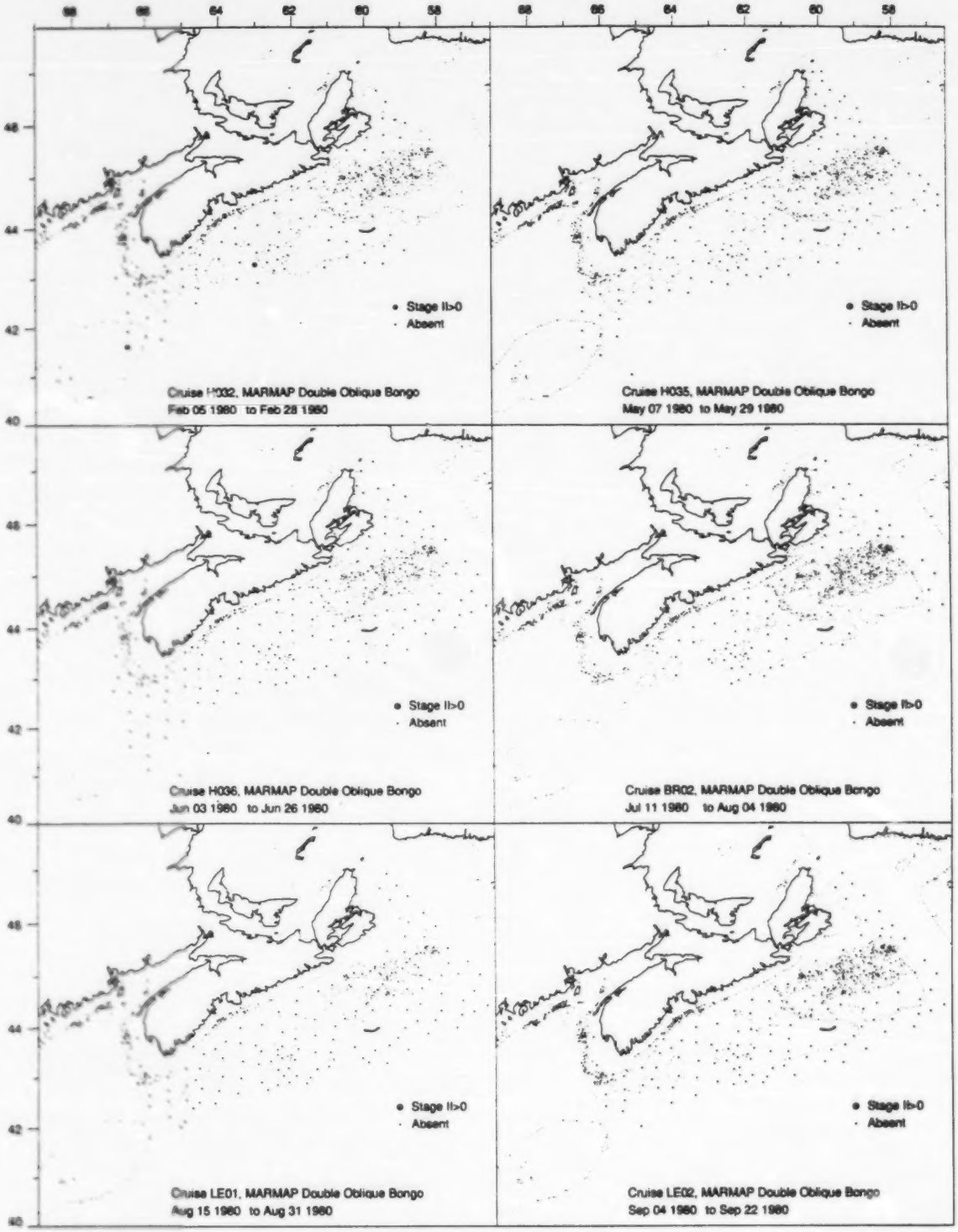
Stage II>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.2. (continued).

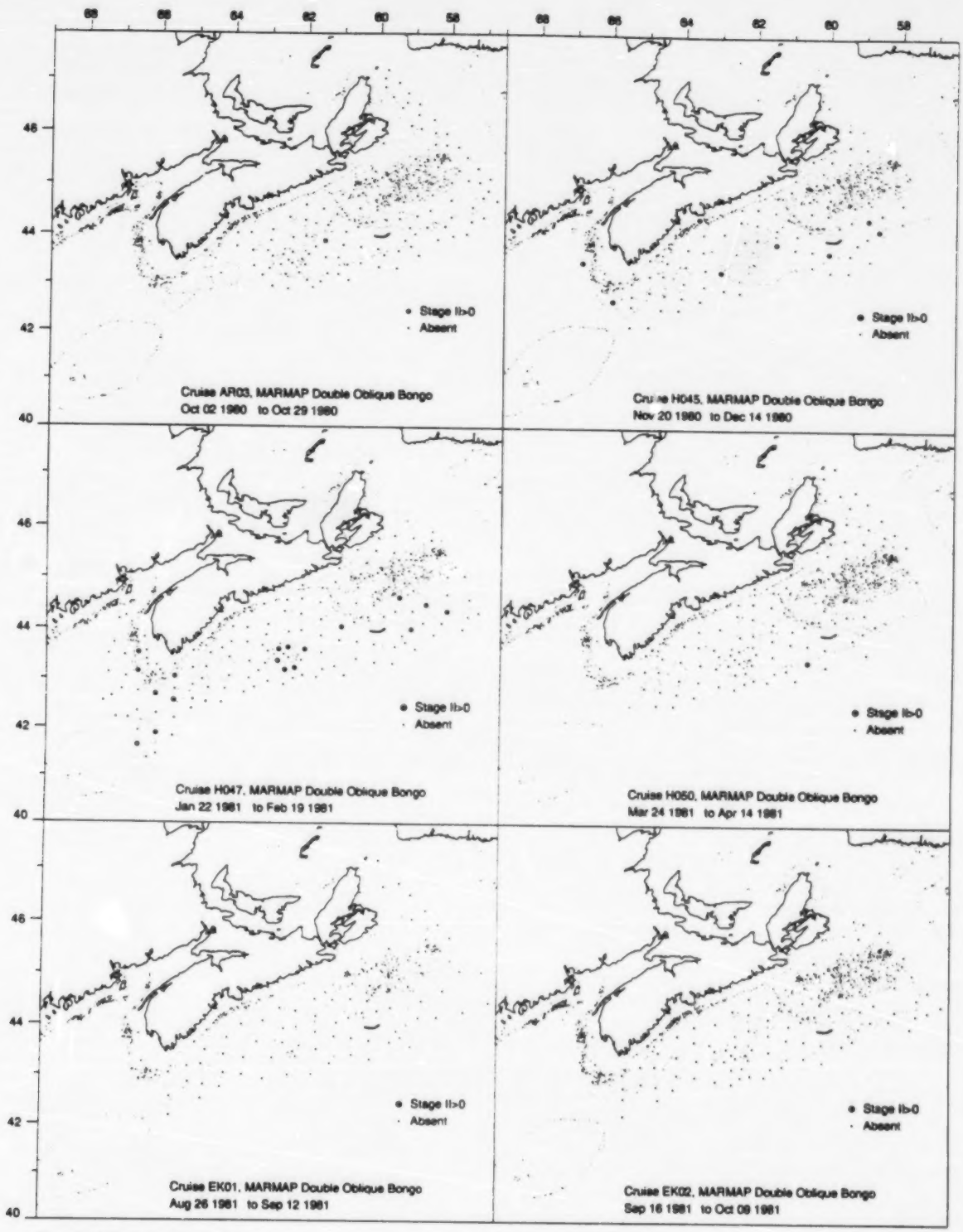
Stage II>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.2. (continued).

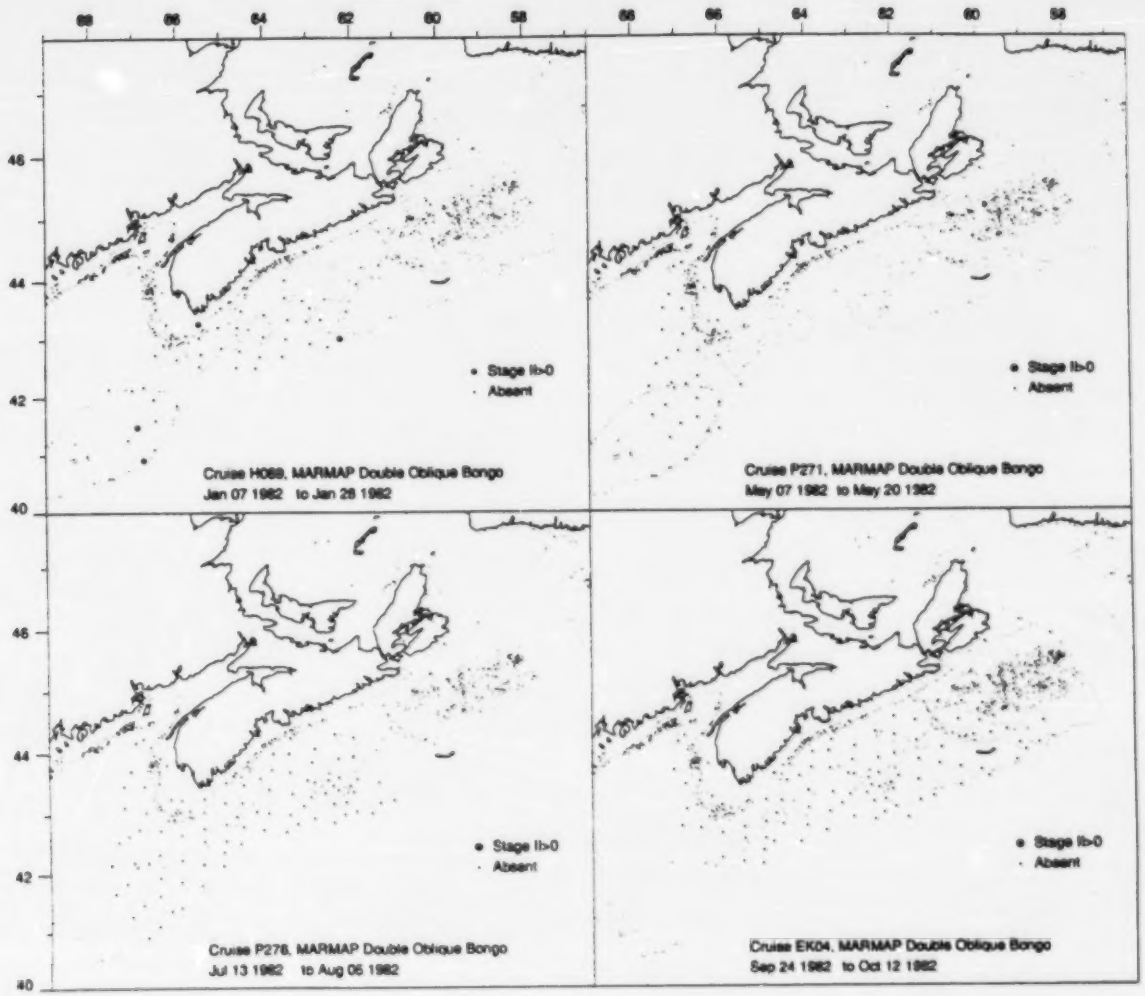
Stage II>0
Absent
Cruise H088, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P278, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 06 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.2. (continued).

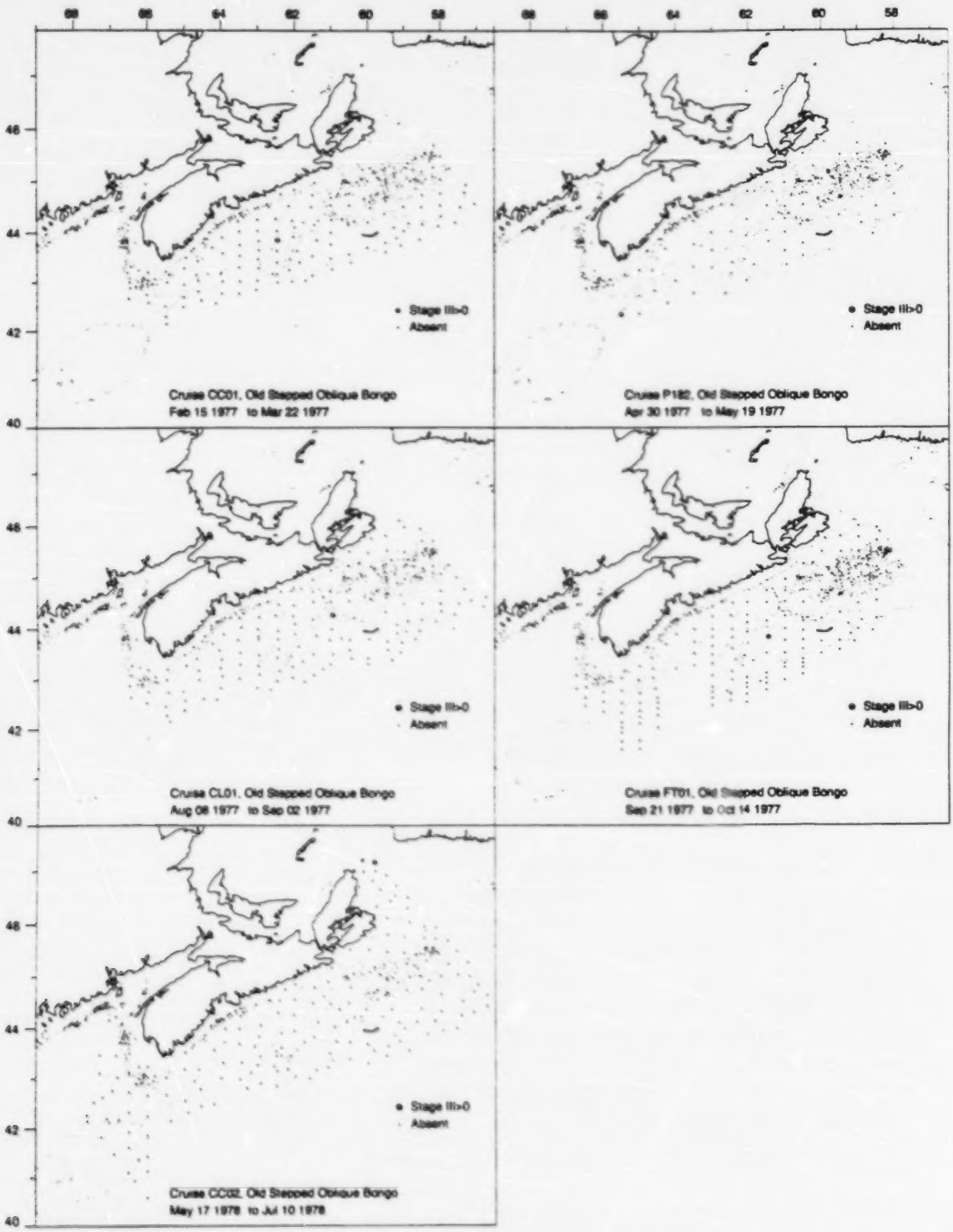

Fig. 8.4.3. Scotian Shelf Ichthyoplankton Program Cruises: Stage III pollock eggs.

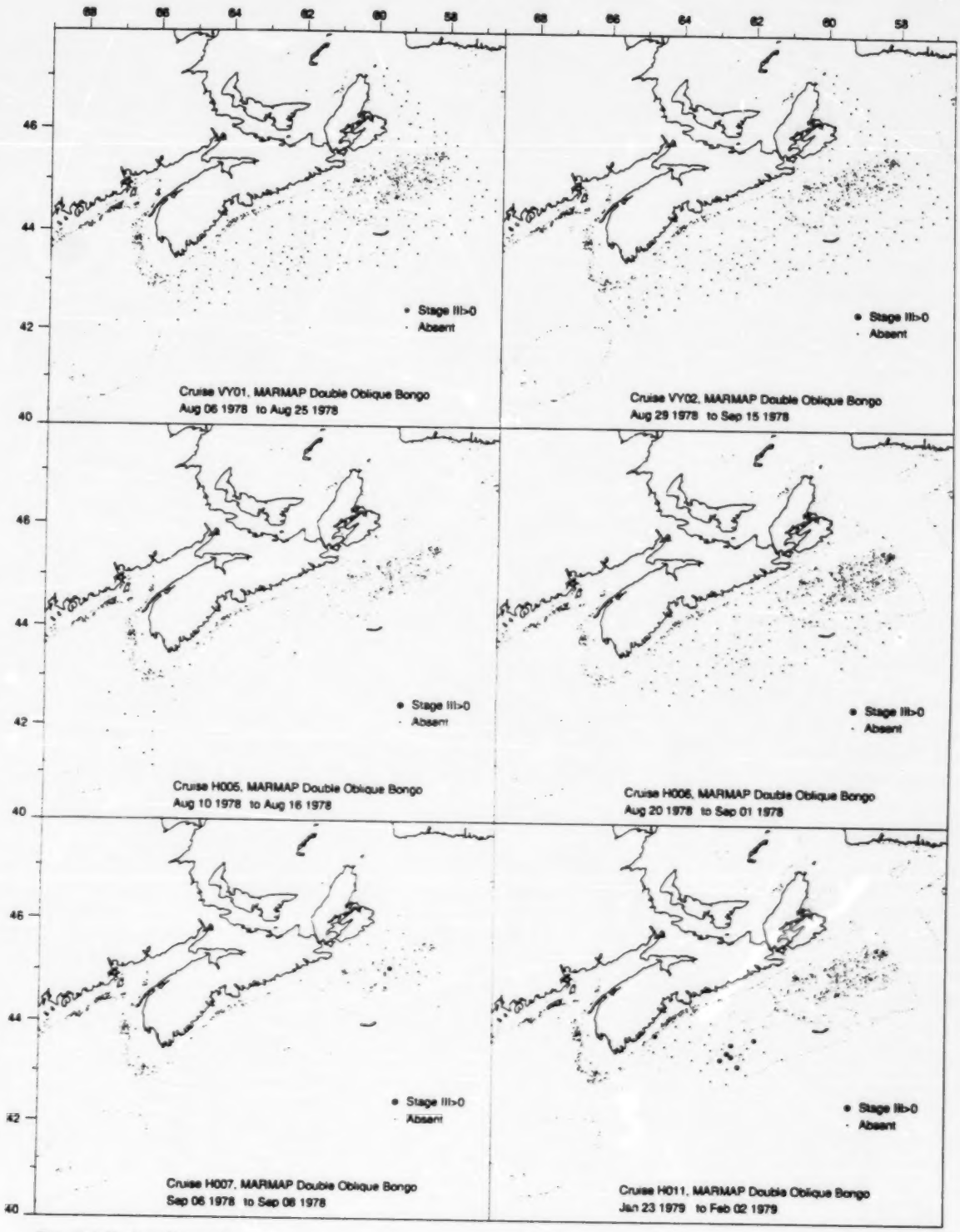

Fig. 8.4.3. (continued).

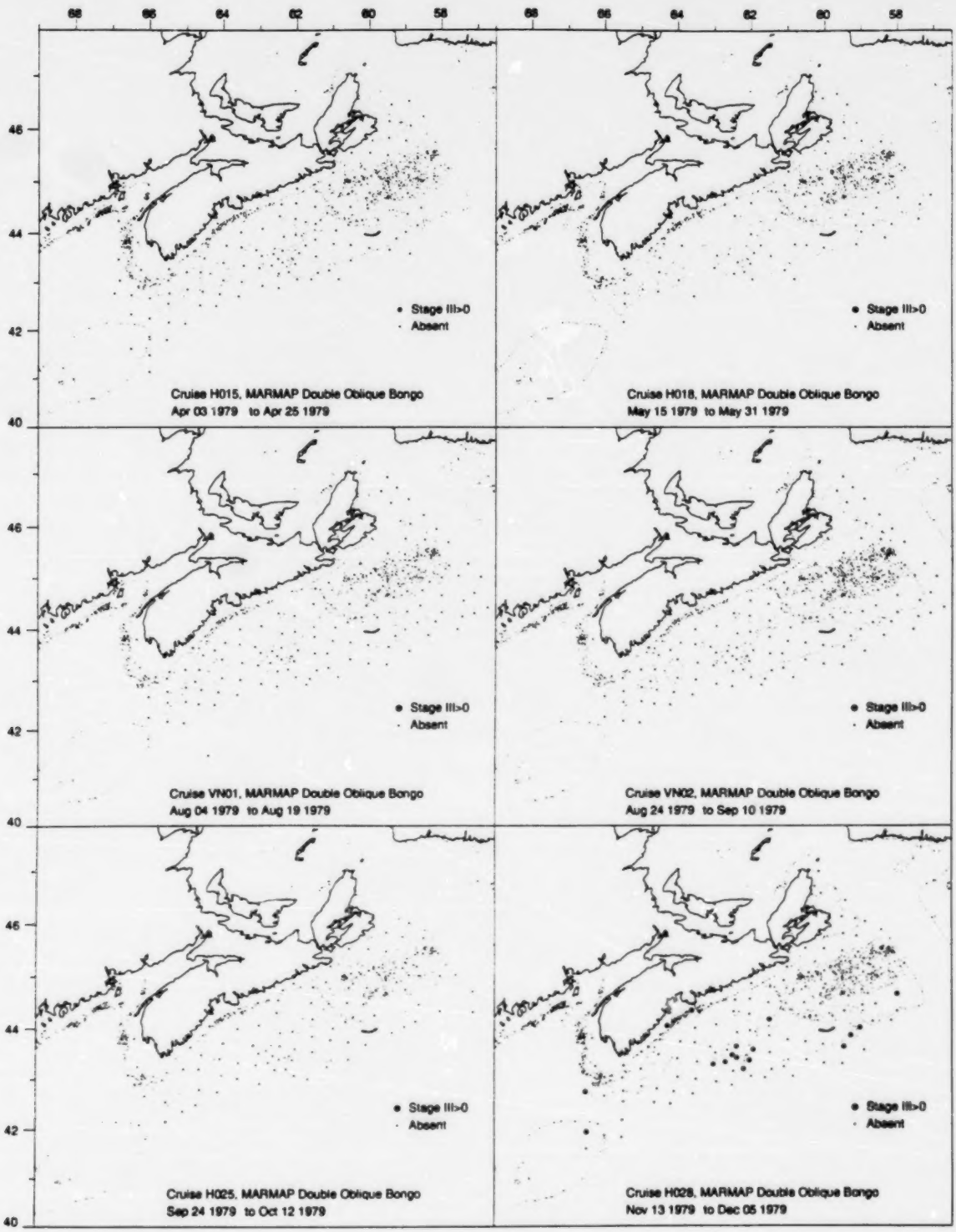

Fig. 8.4.3. (continued).

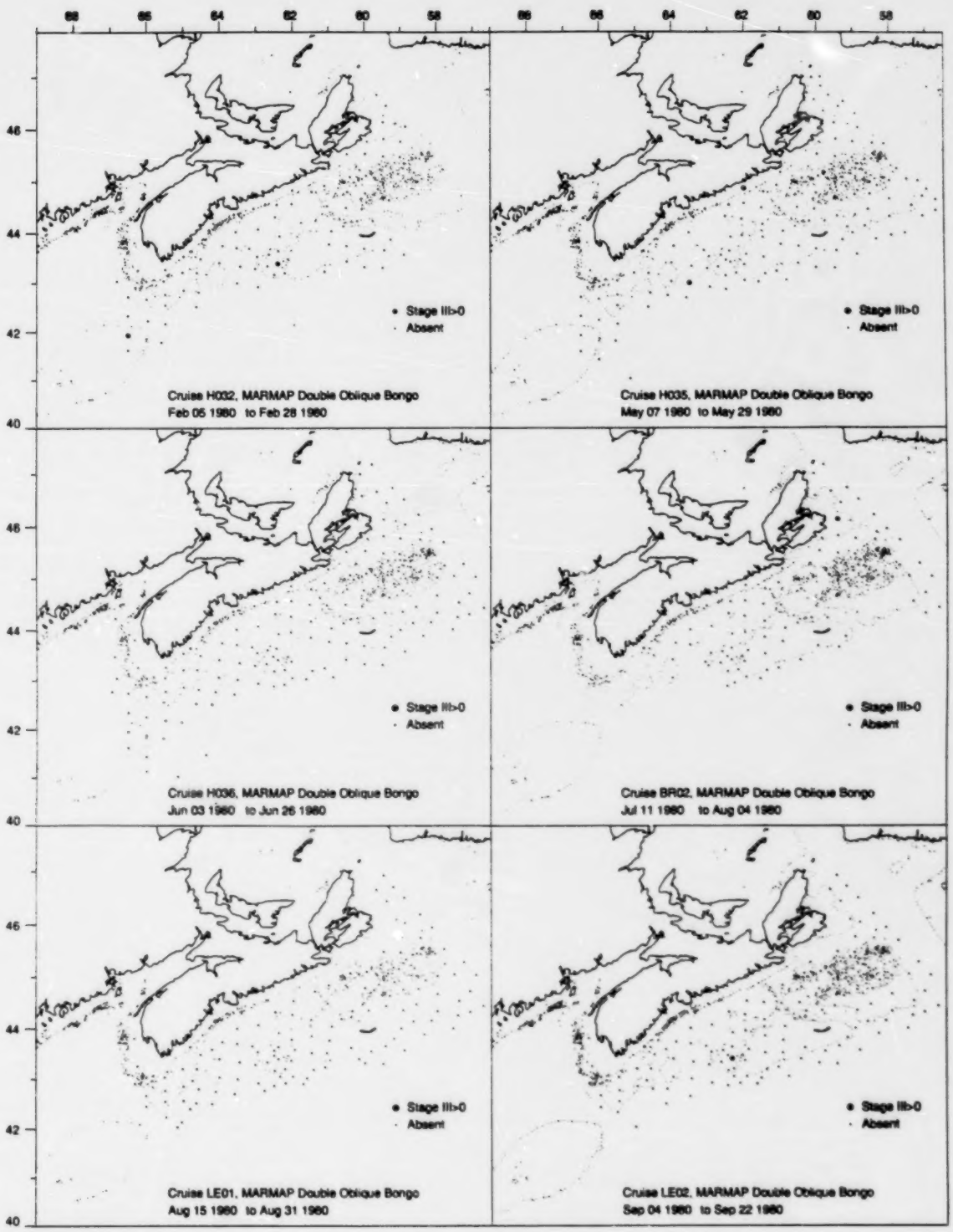

Fig. 8.4.3. (continued).

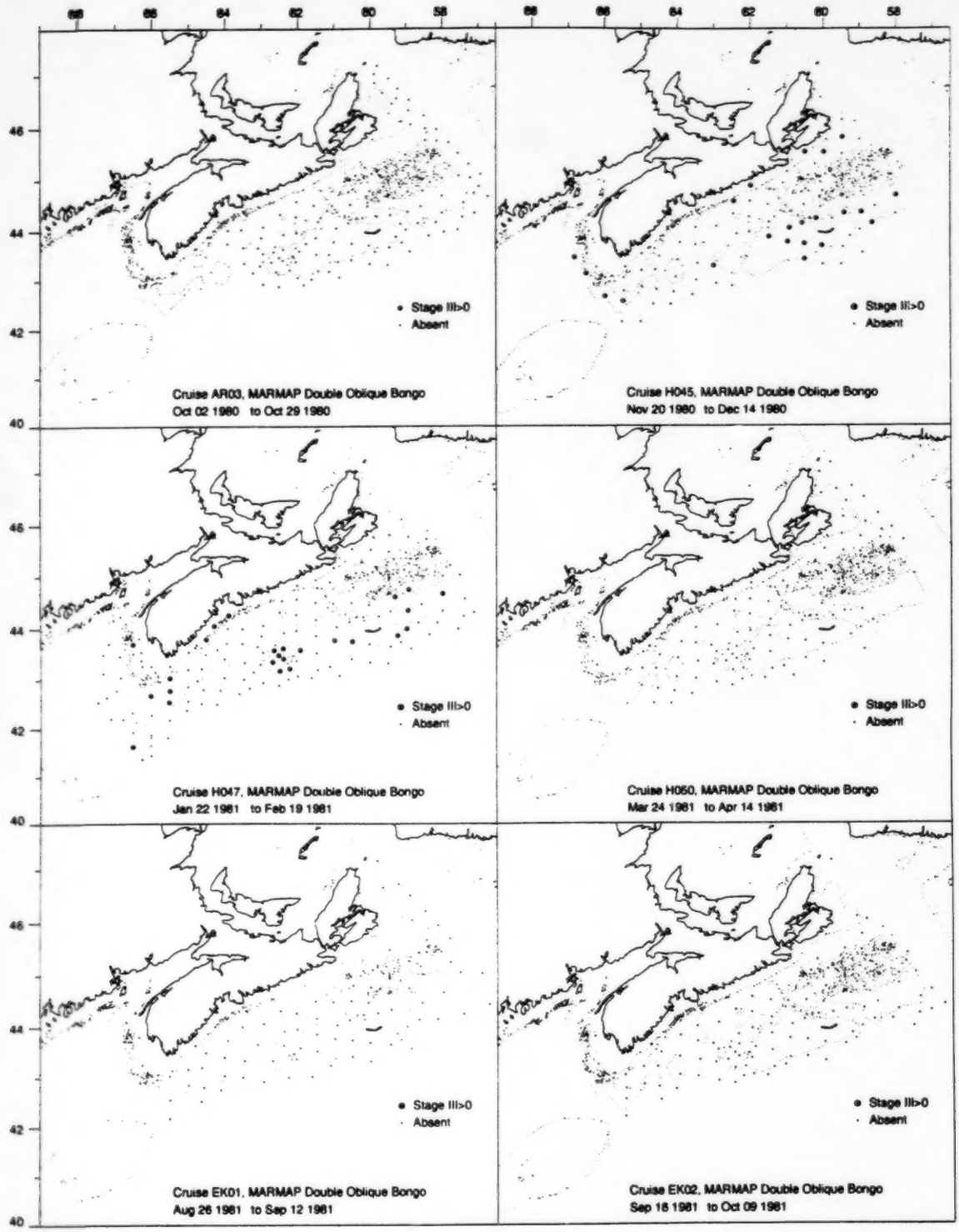
Stage III>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.3. (continued).

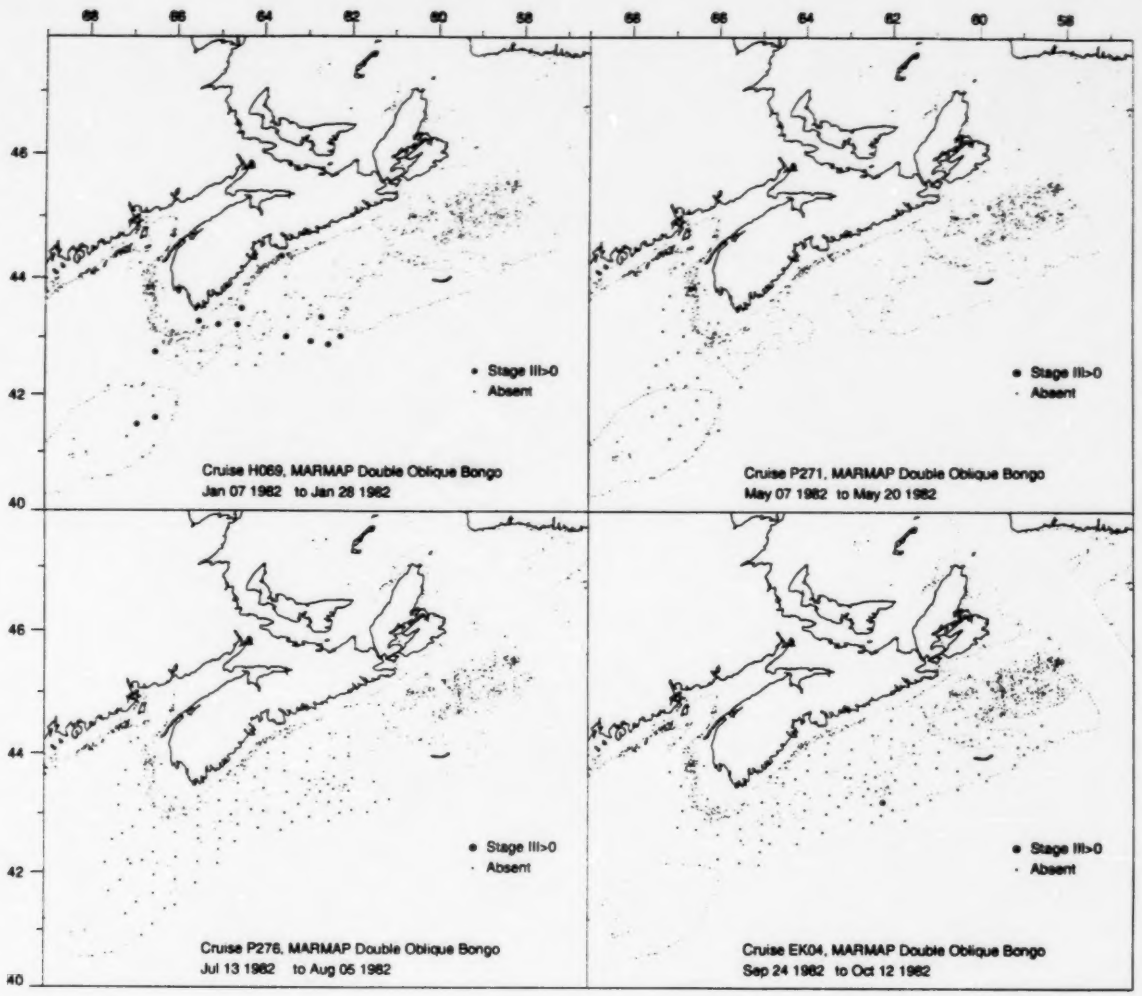

Fig. 8.4.3. (continued).

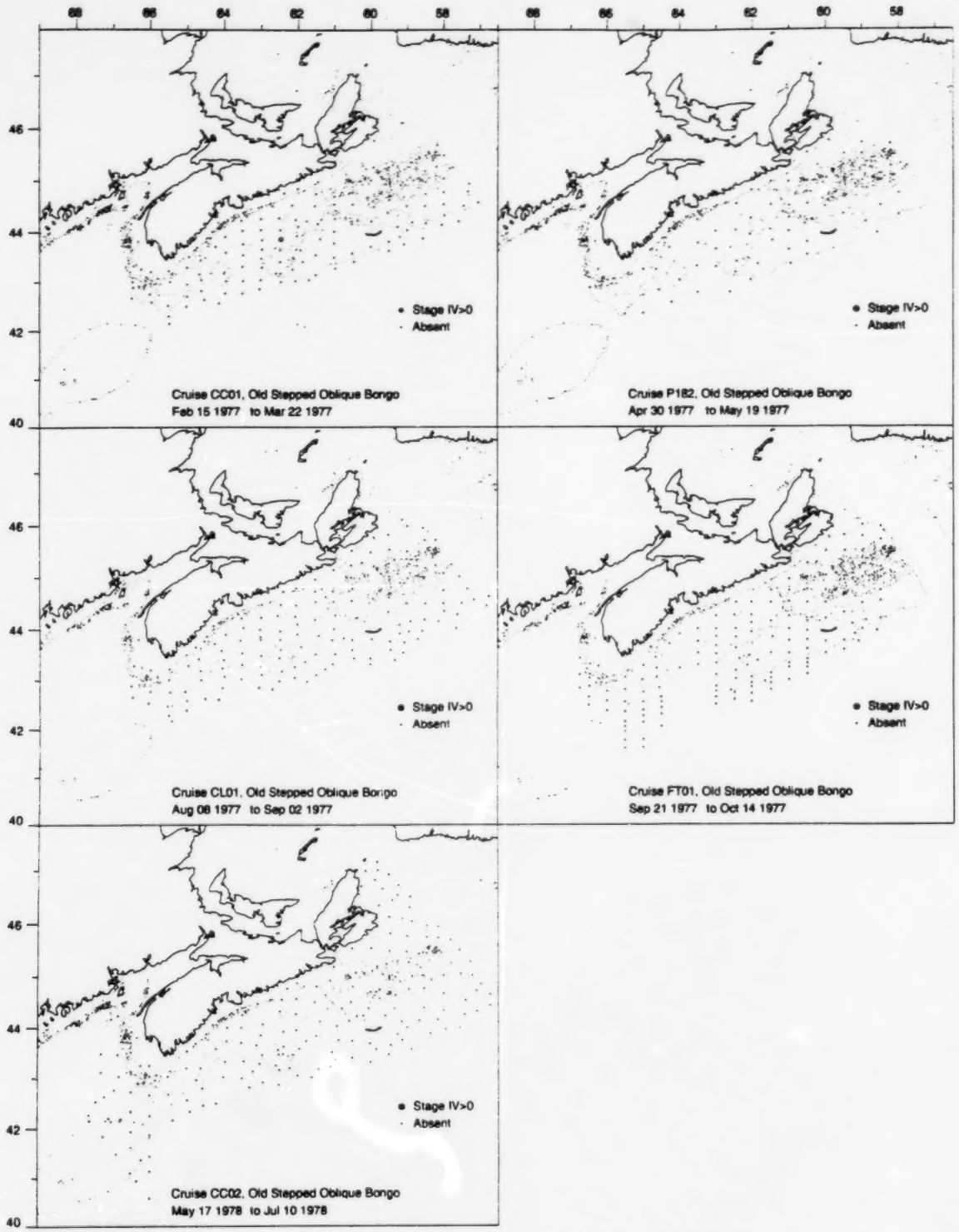

Fig. 8.4.4. Scotian Shelf Ichthyoplankton Program Cruises: Stage IV pollock eggs.

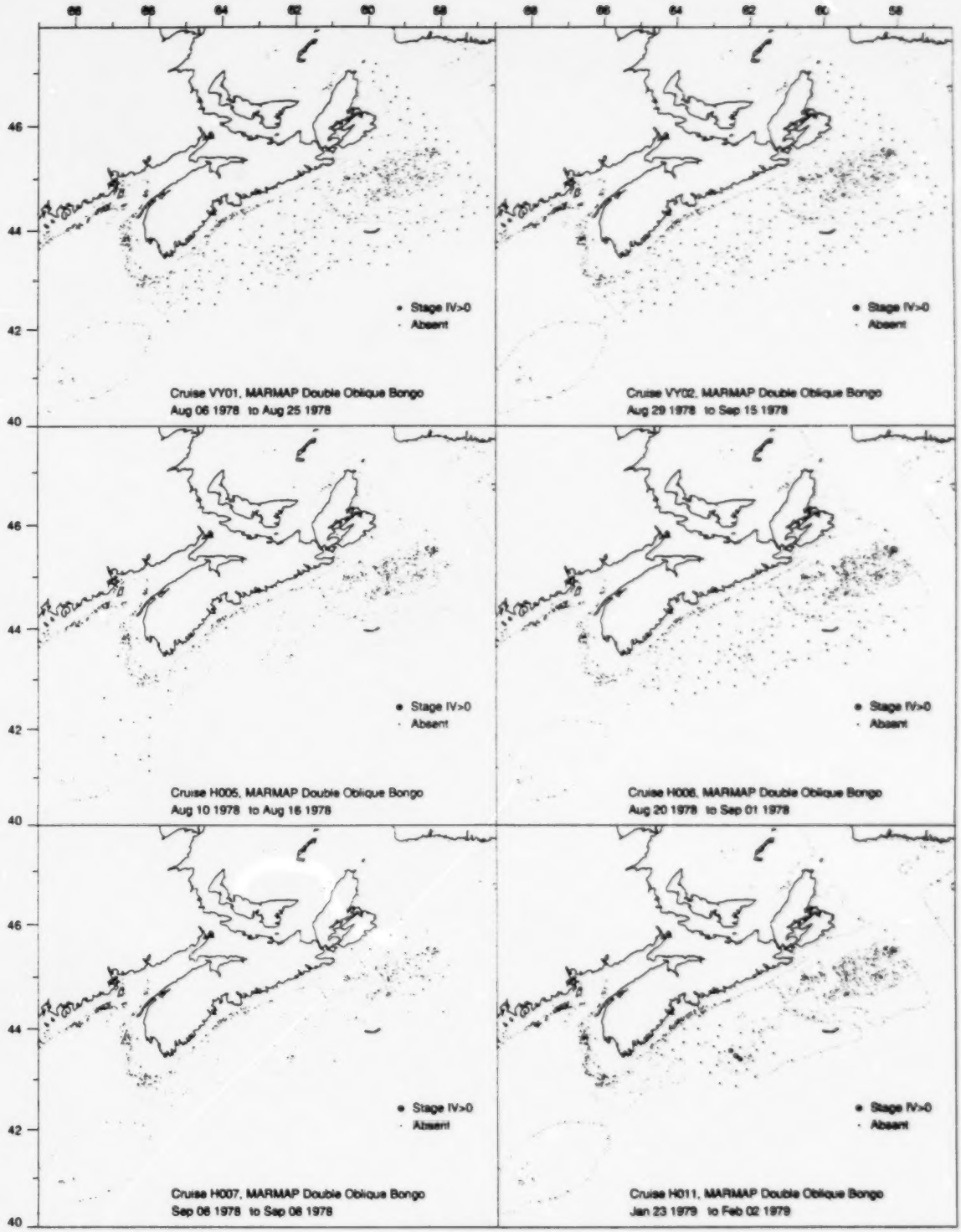
Stage IV>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.4. (continued).

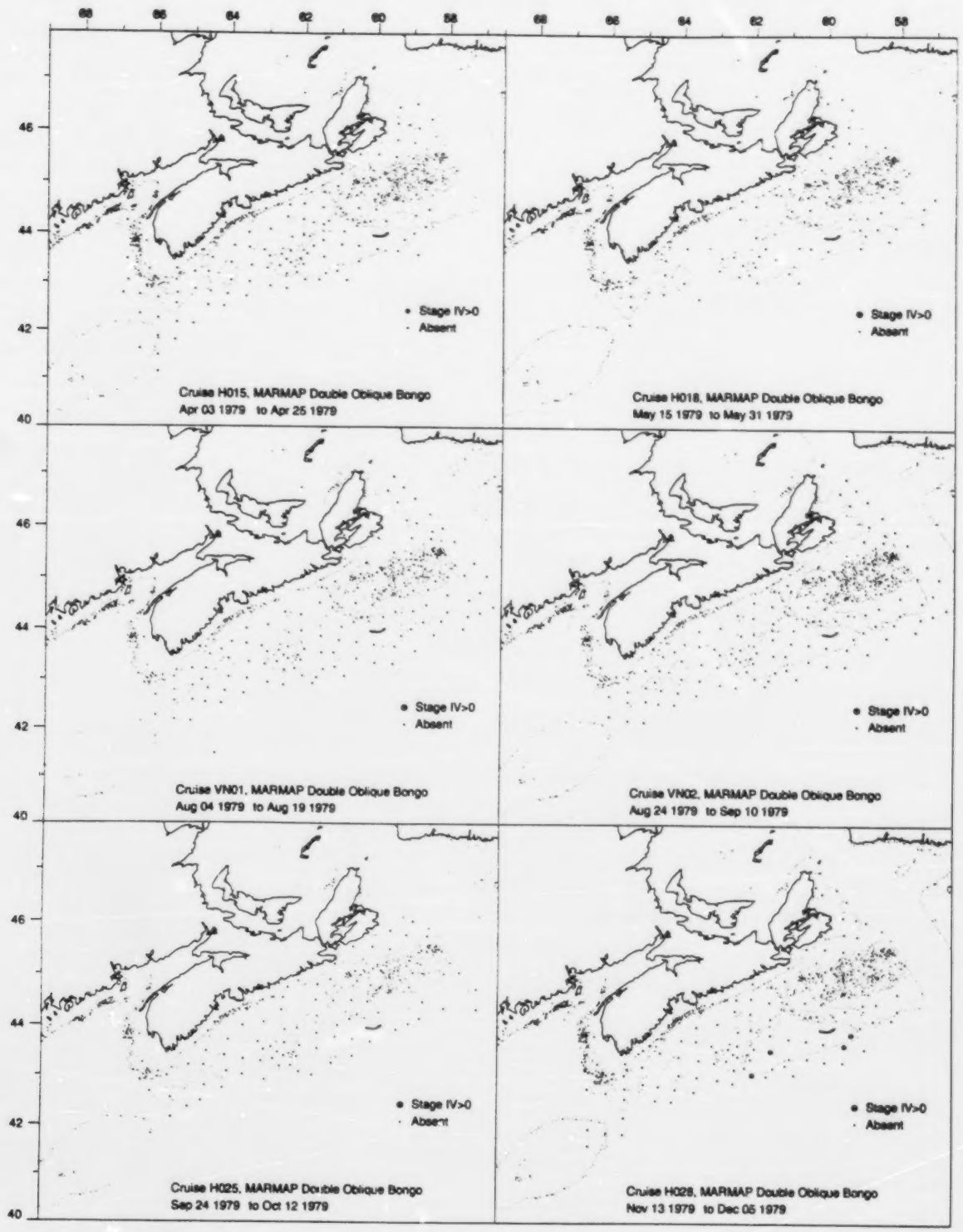

Fig. 8.4.4. (continued).

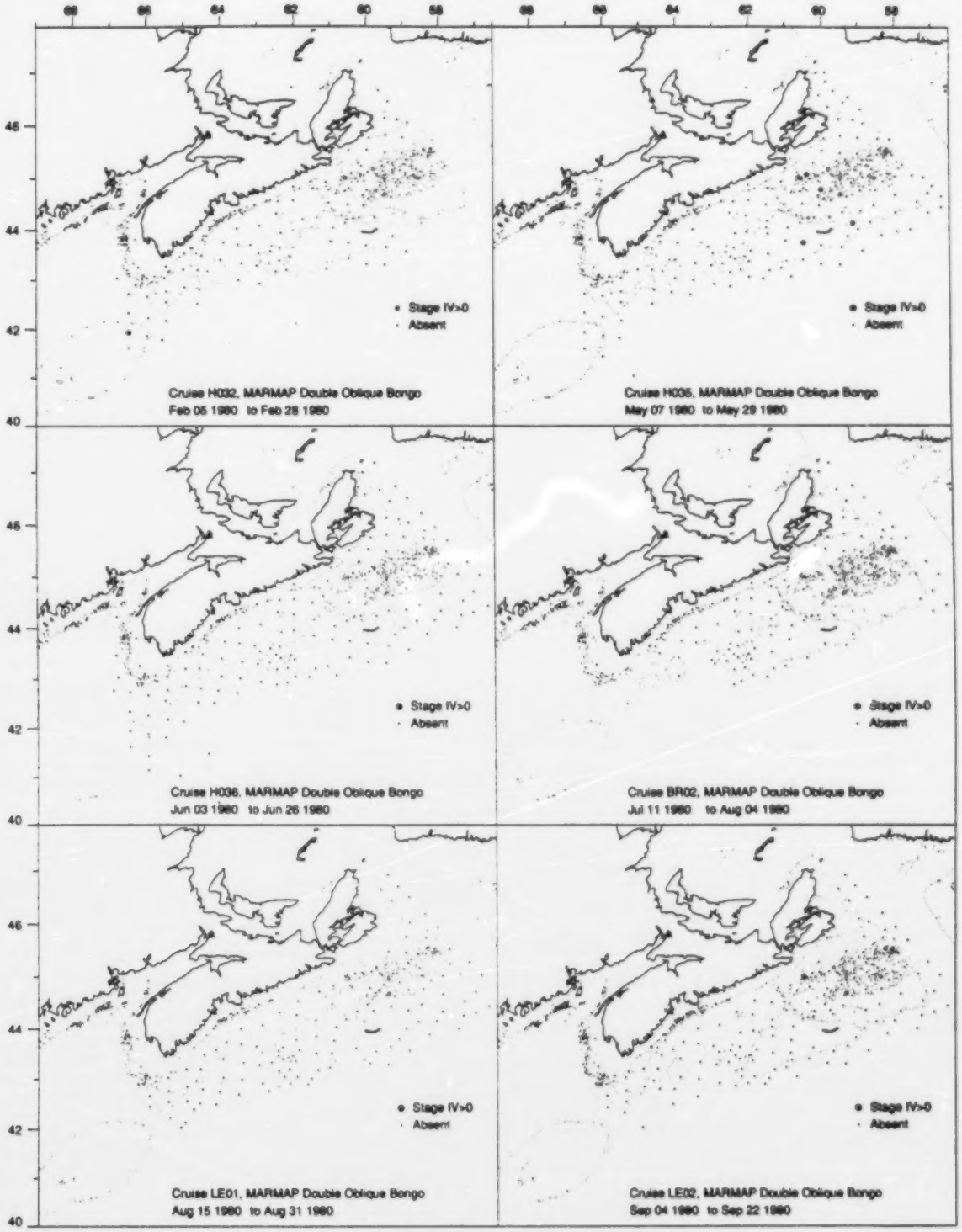
Stage IV>0
Absent
Cruise H032, MARMAP Double Oblique Bongo
Feb 05 1980 to Feb 28 1980
Cruise H035, MARMAP Double Oblique Bongo
May 07 1980 to May 29 1980
Cruise H036, MARMAP Double Oblique Bongo
Jun 03 1980 to Jun 26 1980
Cruise BR02, MARMAP Double Oblique Bongo
Jul 11 1980 to Aug 04 1980
Cruise LE01, MARMAP Double Oblique Bongo
Aug 15 1980 to Aug 31 1980
Cruise LE02, MARMAP Double Oblique Bongo
Sep 04 1980 to Sep 22 1980

Fig. 8.4.4. (continued).

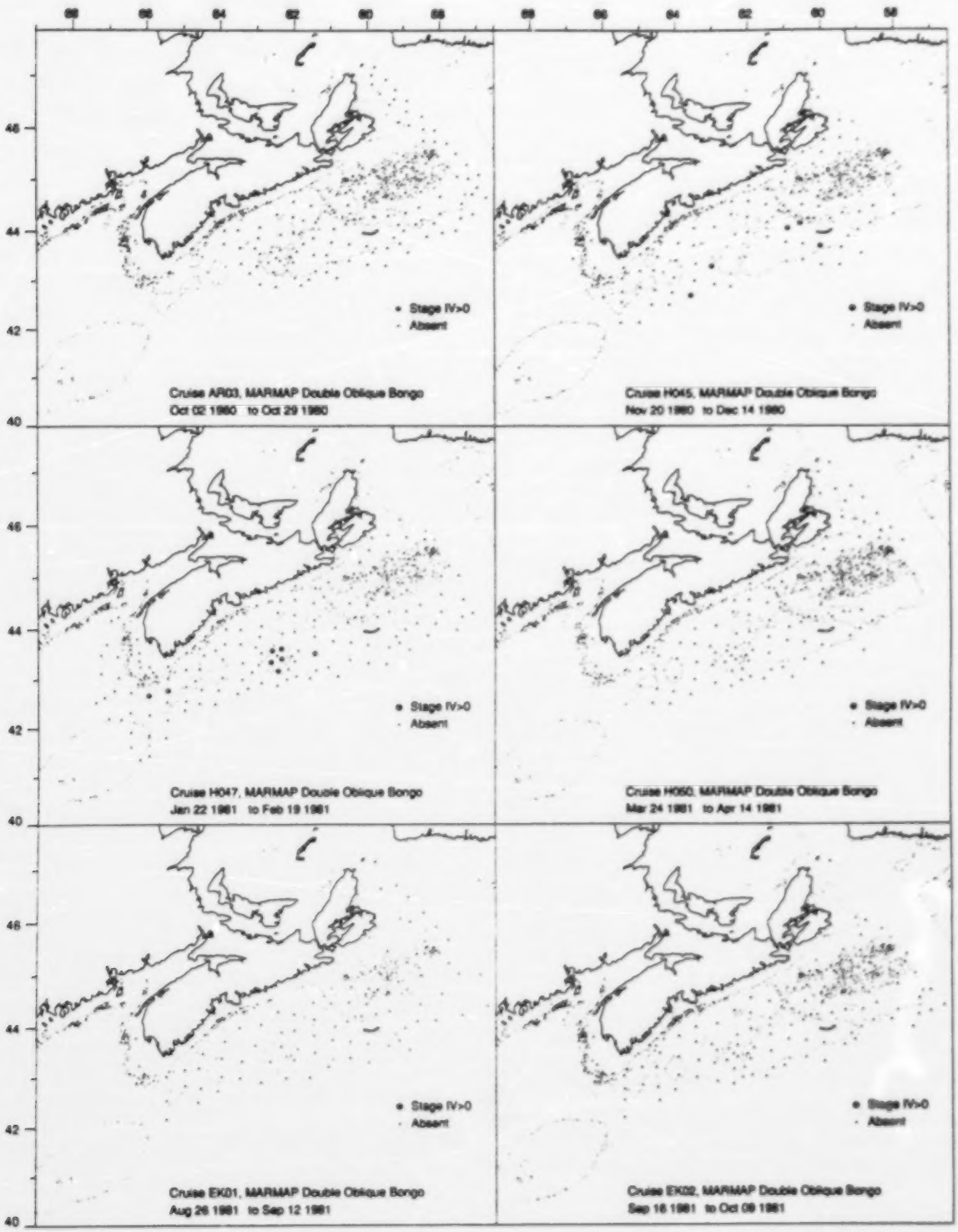
Stage IV>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.4. (continued).

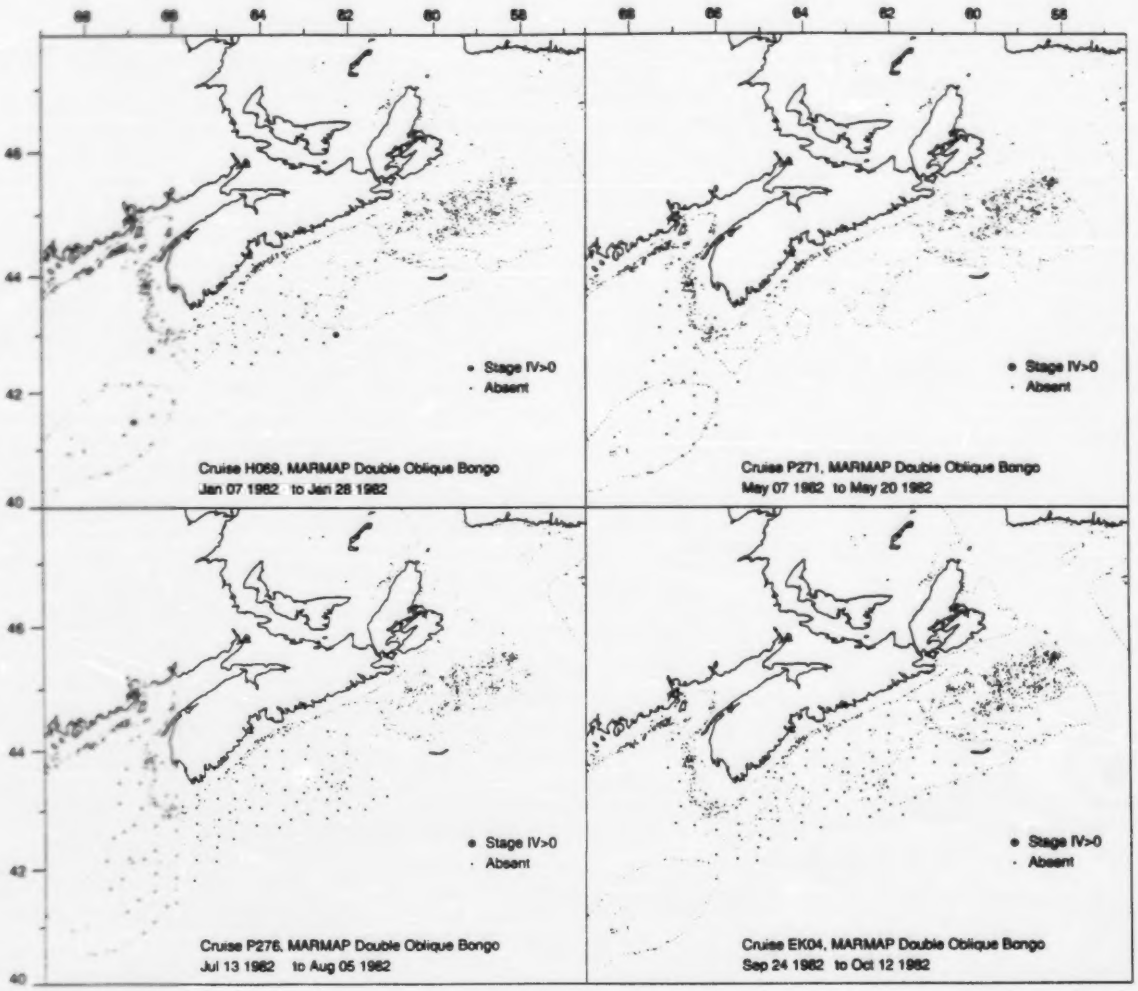
Stage IV>0
Absent
Cruise H089, MARMAP Double Oblique Bongo
Jan 07 1982 to Jan 28 1982
Cruise P271, MARMAP Double Oblique Bongo
May 07 1982 to May 20 1982
Cruise P276, MARMAP Double Oblique Bongo
Jul 13 1982 to Aug 05 1982
Cruise EK04, MARMAP Double Oblique Bongo
Sep 24 1982 to Oct 12 1982

Fig. 8.4.4. (continued).

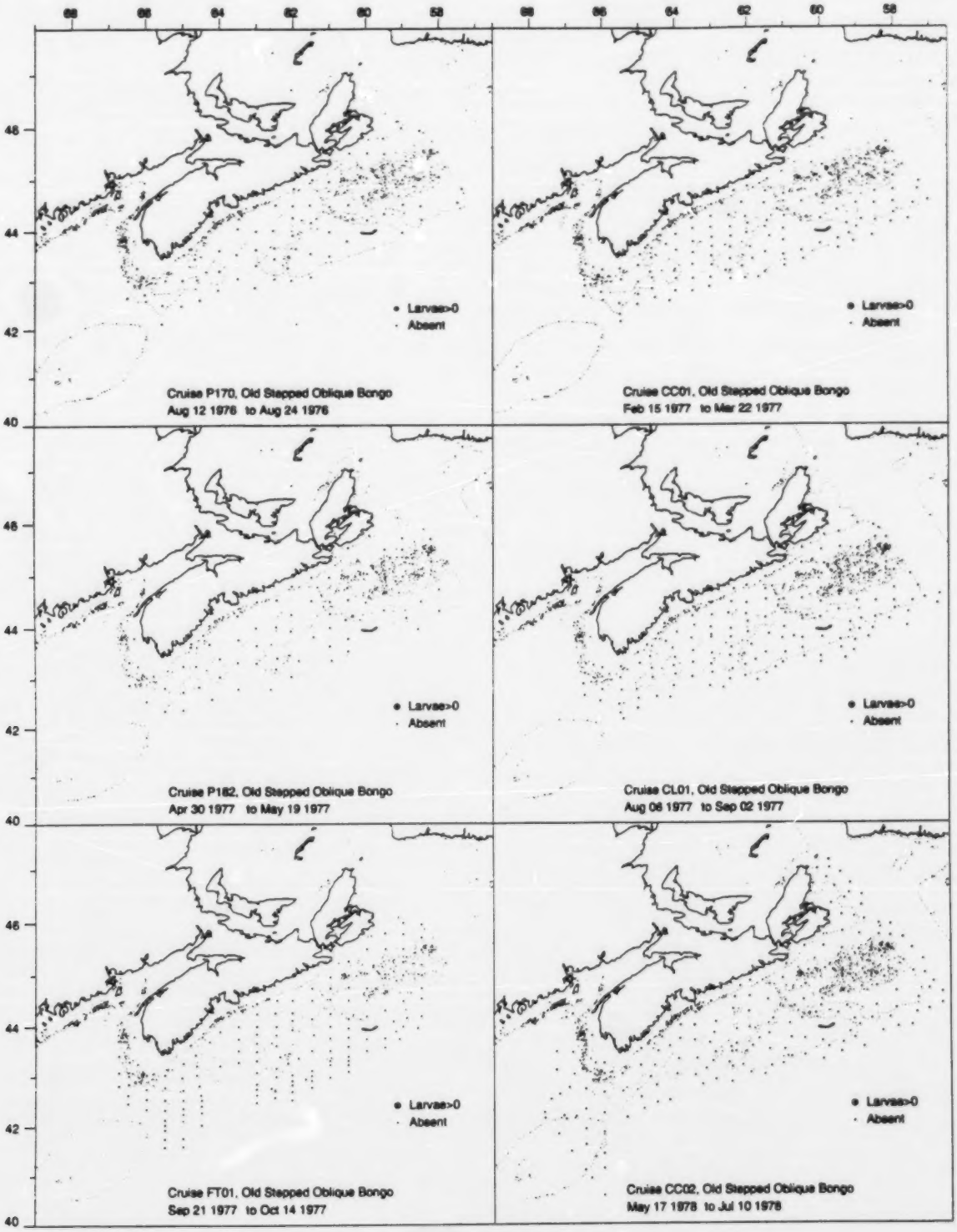

Fig. 8.4.5. Scotian Shelf Ichthyoplankton Program Cruises: Pollock larvae (1-7mm).

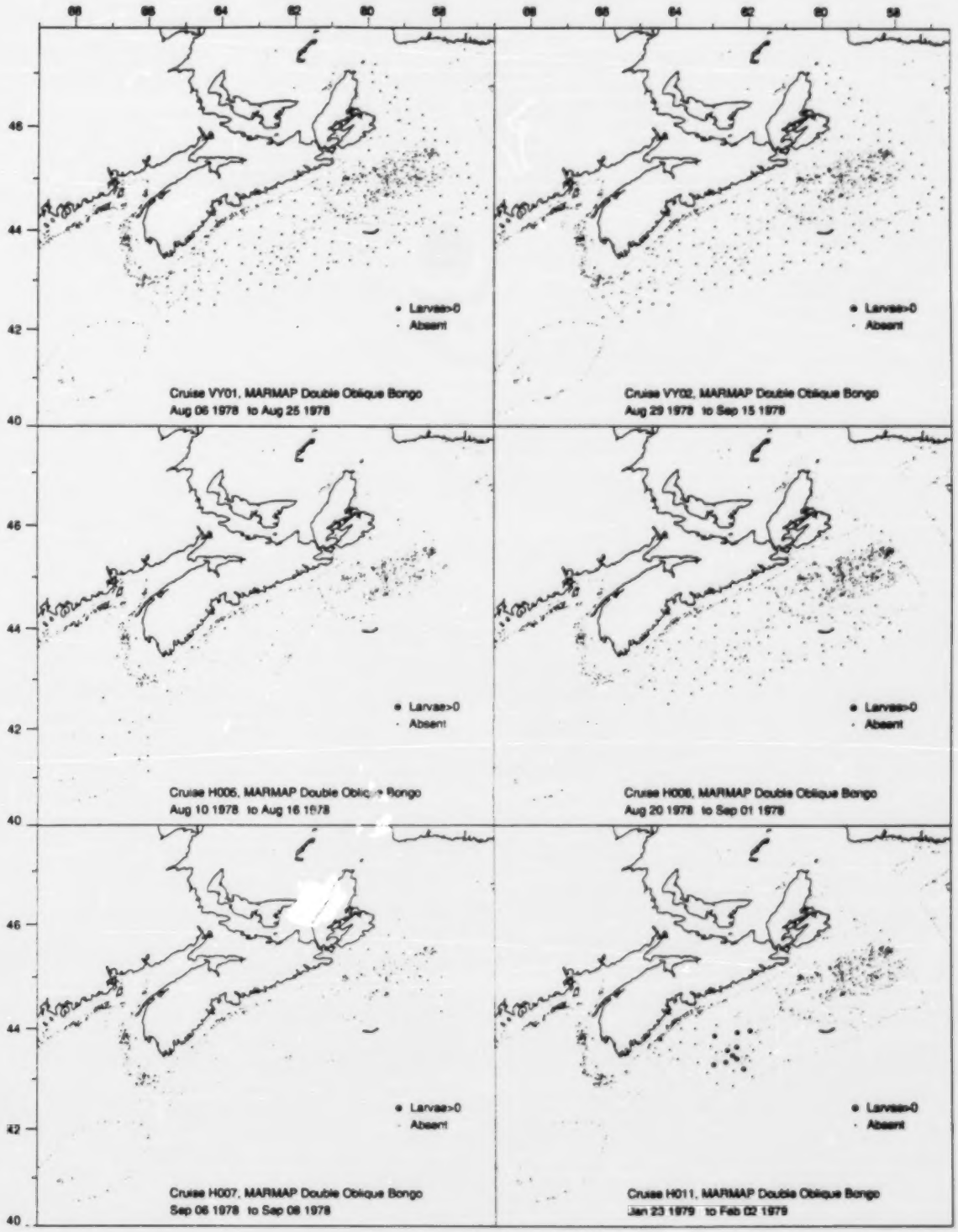
Larvae>0
Absent
Cruise VY01, MARMAP Double Oblique Bongo
Aug 06 1978 to Aug 25 1978
Cruise VY02, MARMAP Double Oblique Bongo
Aug 29 1978 to Sep 15 1978
Cruise H005, MARMAP Double Oblique Bongo
Aug 10 1978 to Aug 16 1978
Cruise H006, MARMAP Double Oblique Bongo
Aug 20 1978 to Sep 01 1978
Cruise H007, MARMAP Double Oblique Bongo
Sep 06 1978 to Sep 08 1978
Cruise H011, MARMAP Double Oblique Bongo
Jan 23 1979 to Feb 02 1979

Fig. 8.4.5. (continued).

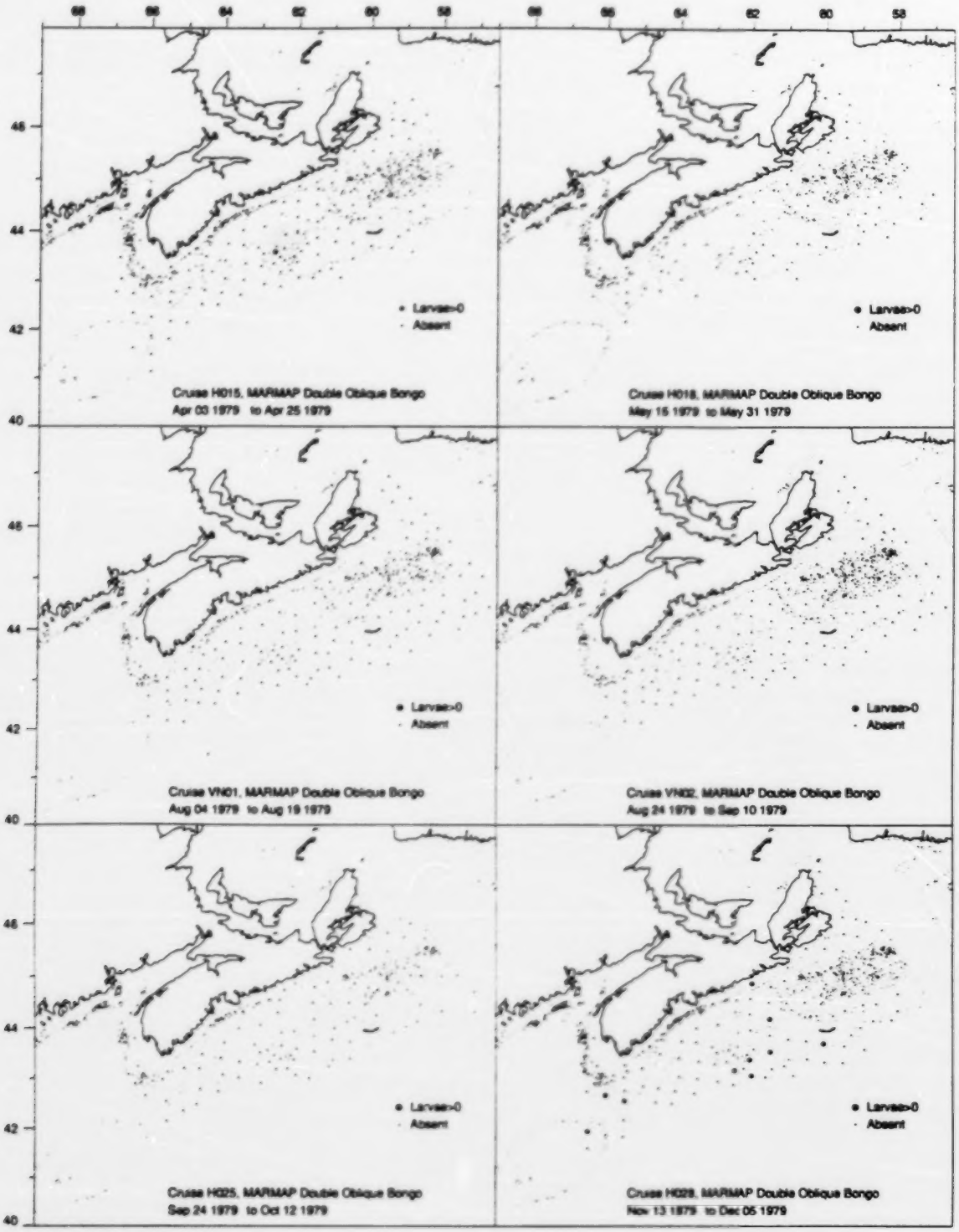
Larvae>0
Absent
Cruise H015, MARMAP Double Oblique Bongo
Apr 03 1979 to Apr 25 1979
Cruise H018, MARMAP Double Oblique Bongo
May 15 1979 to May 31 1979
Cruise VN01, MARMAP Double Oblique Bongo
Aug 04 1979 to Aug 19 1979
Cruise VN02, MARMAP Double Oblique Bongo
Aug 24 1979 to Sep 10 1979
Cruise H025, MARMAP Double Oblique Bongo
Sep 24 1979 to Oct 12 1979
Cruise H029, MARMAP Double Oblique Bongo
Nov 13 1979 to Dec 05 1979

Fig. 8.4.5. (continued).

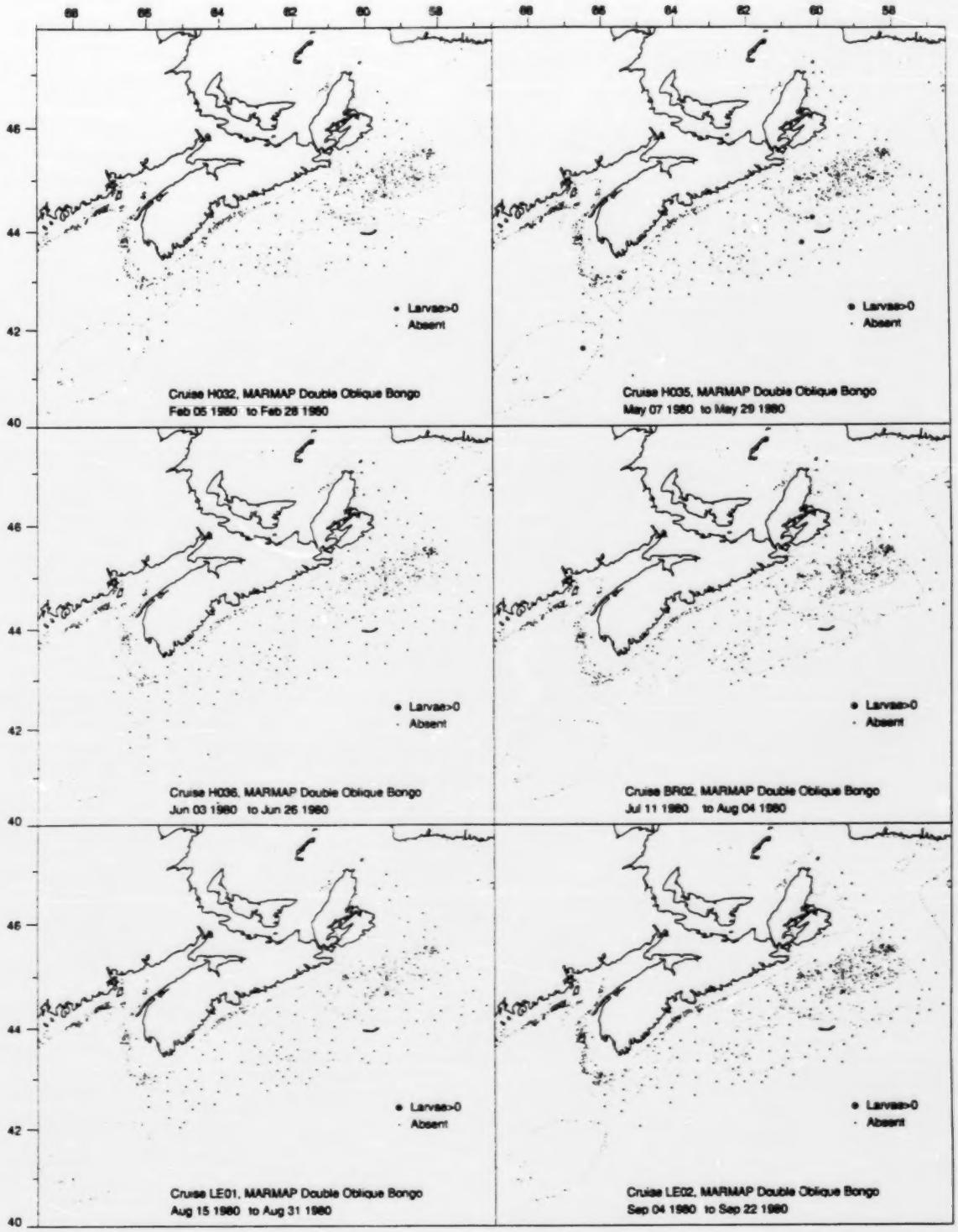

Fig. 8.4.5. (continued).

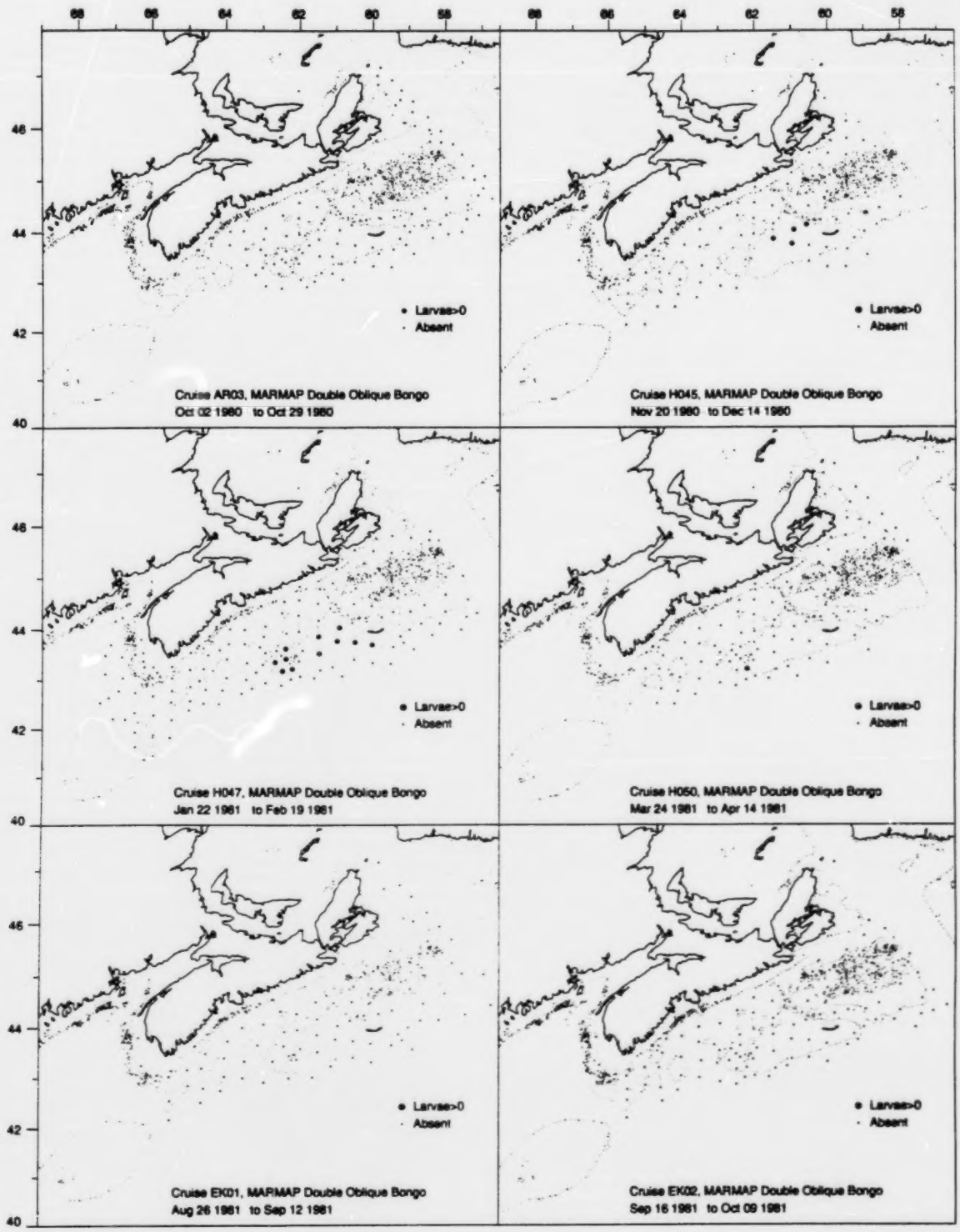
Larvae>0
Absent
Cruise AR03, MARMAP Double Oblique Bongo
Oct 02 1980 to Oct 29 1980
Cruise H045, MARMAP Double Oblique Bongo
Nov 20 1980 to Dec 14 1980
Cruise H047, MARMAP Double Oblique Bongo
Jan 22 1981 to Feb 19 1981
Cruise H050, MARMAP Double Oblique Bongo
Mar 24 1981 to Apr 14 1981
Cruise EK01, MARMAP Double Oblique Bongo
Aug 26 1981 to Sep 12 1981
Cruise EK02, MARMAP Double Oblique Bongo
Sep 16 1981 to Oct 09 1981

Fig. 8.4.5. (continued).

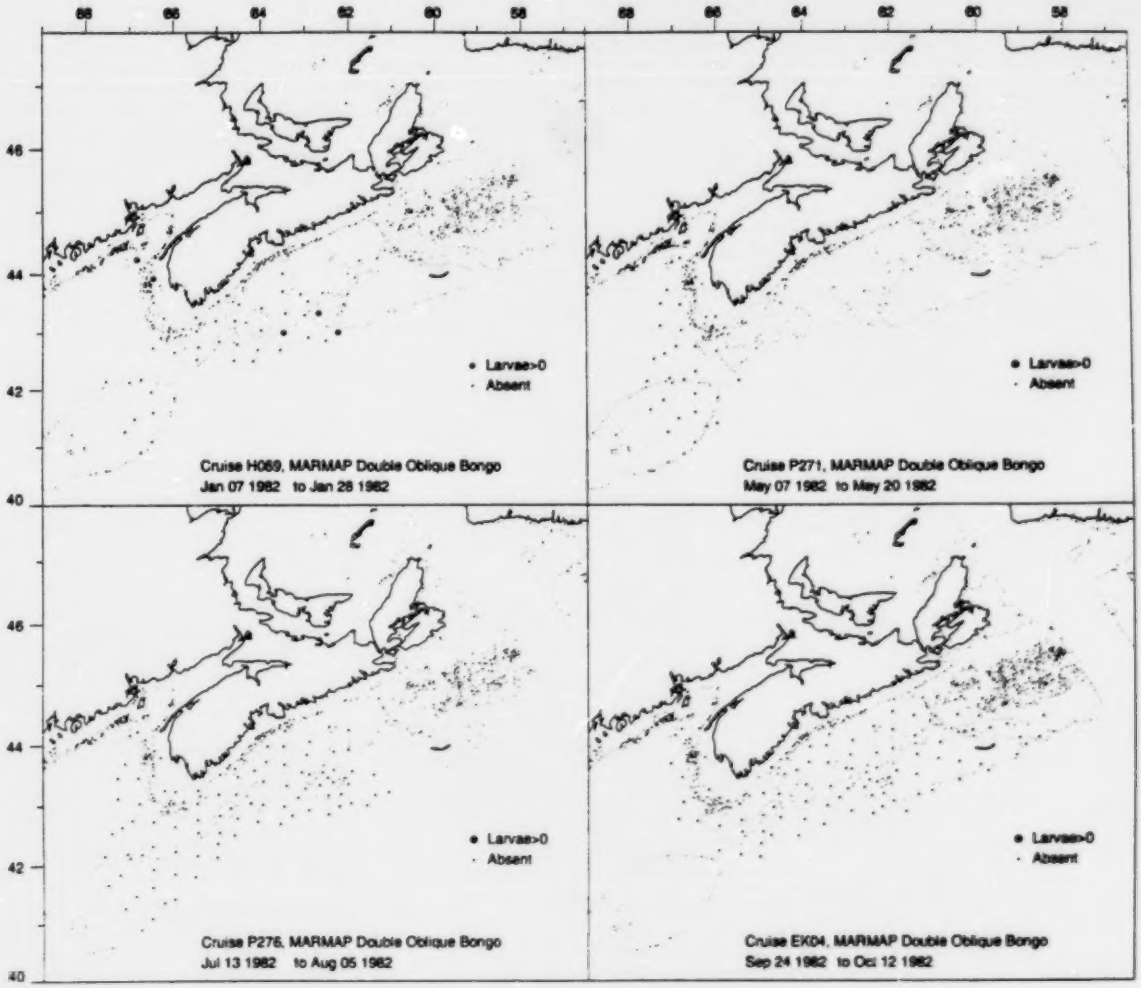

Fig. 8.4.5. (continued).

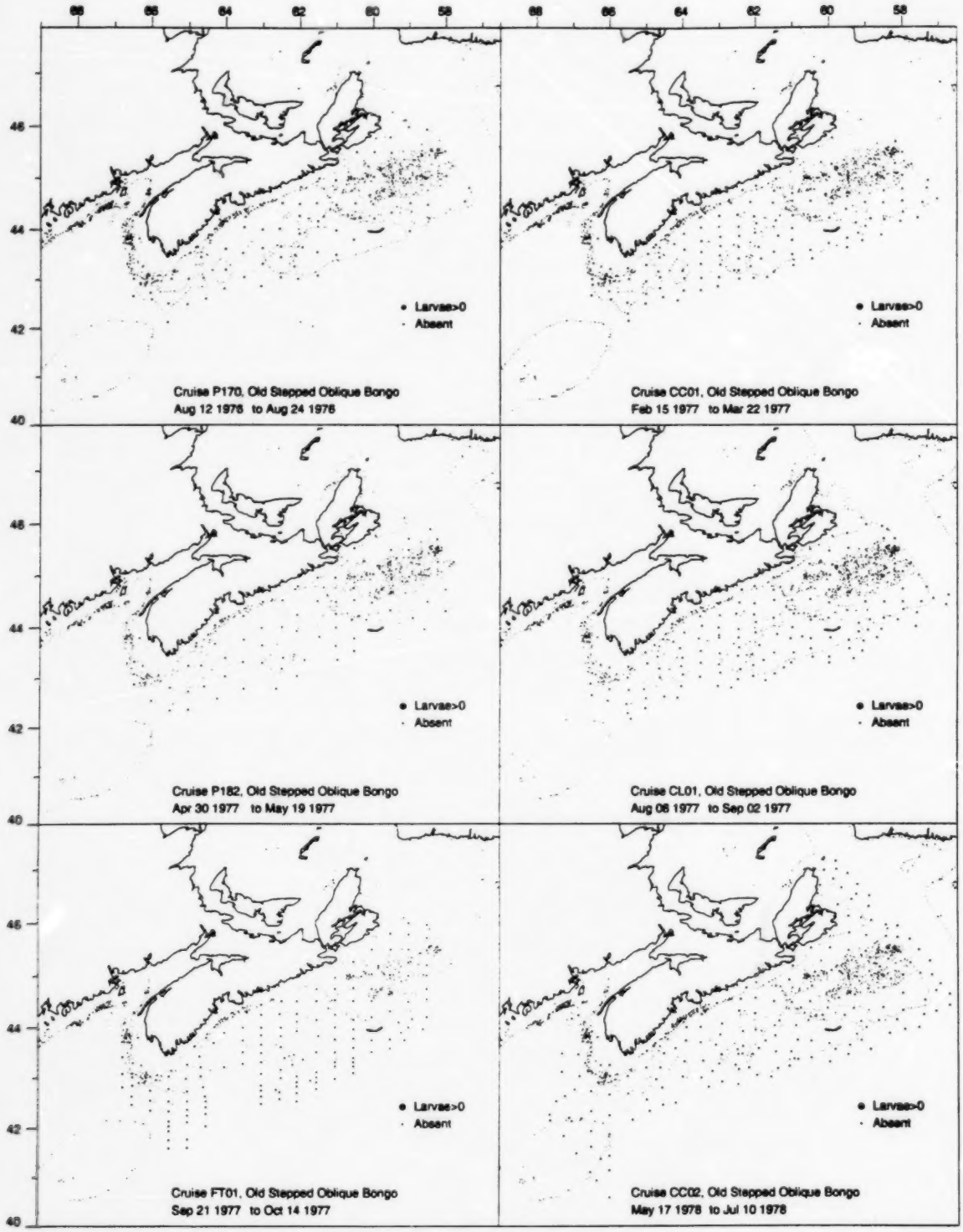

Fig. 8.4.6. Scotian Shelf Ichthyoplankton Program Cruises: Pollock larvae (7+mm).

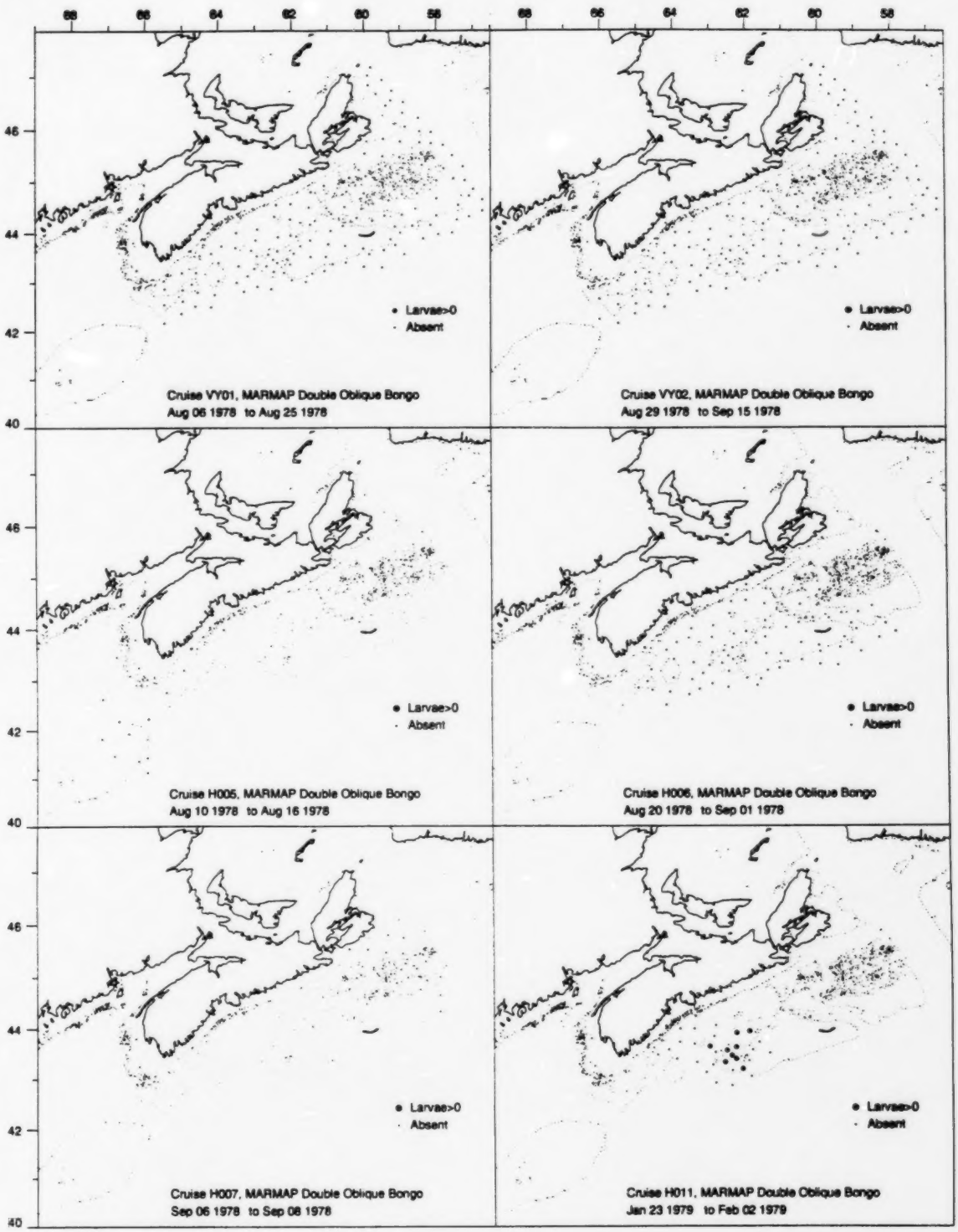

Fig. 8.4.6. (continued).

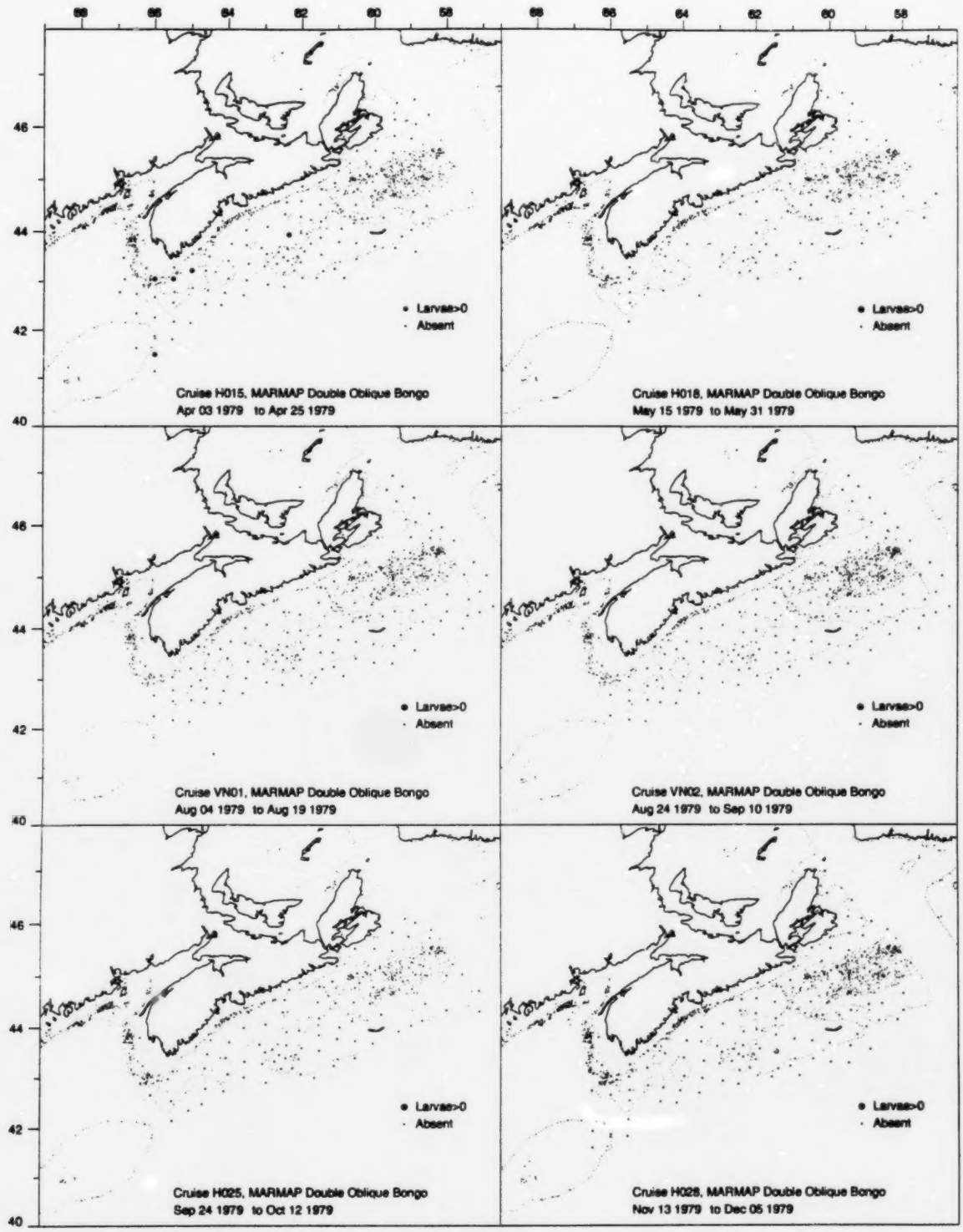

Fig. 8.4.6. (continued).

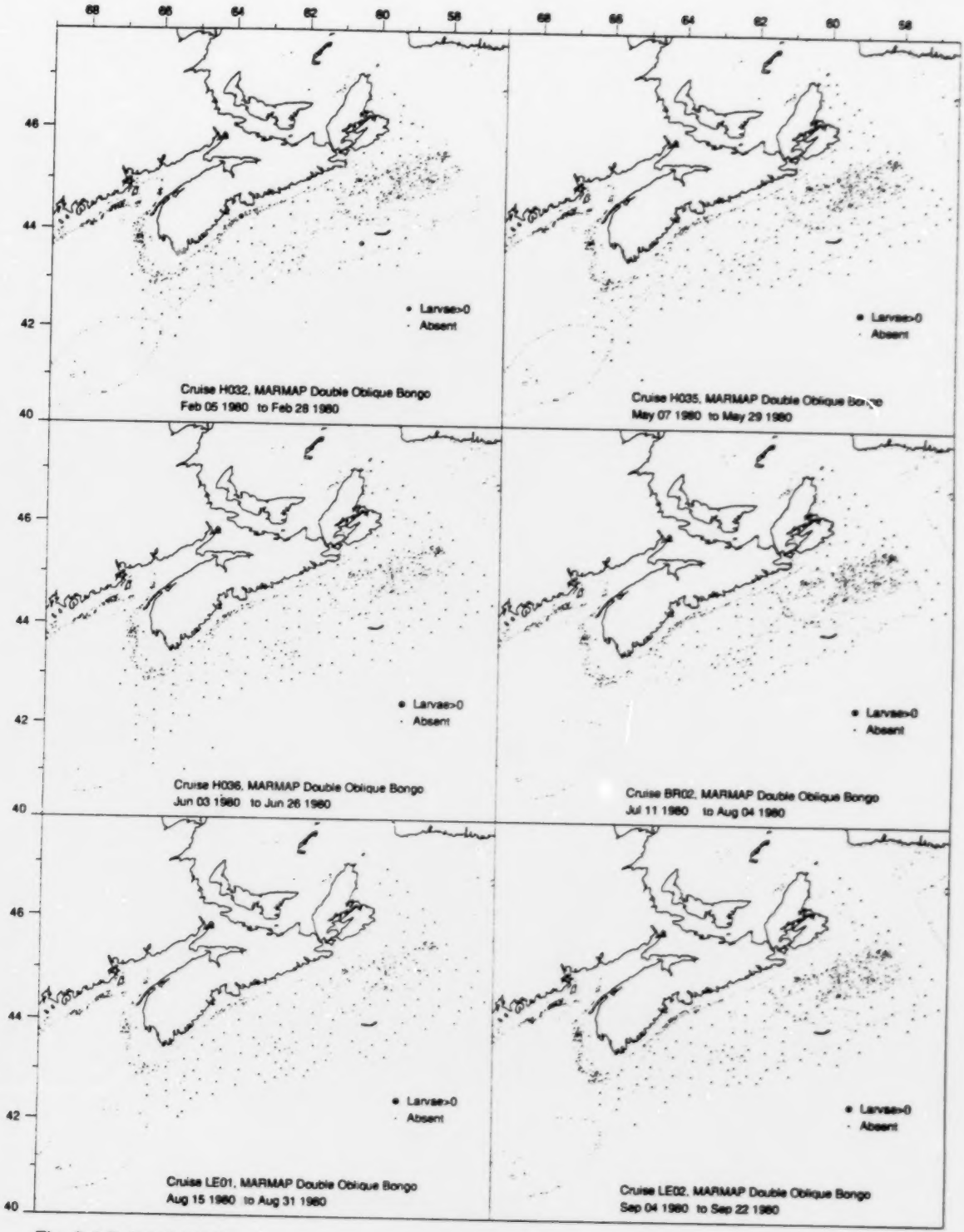

Fig. 8.4.6. (continued).

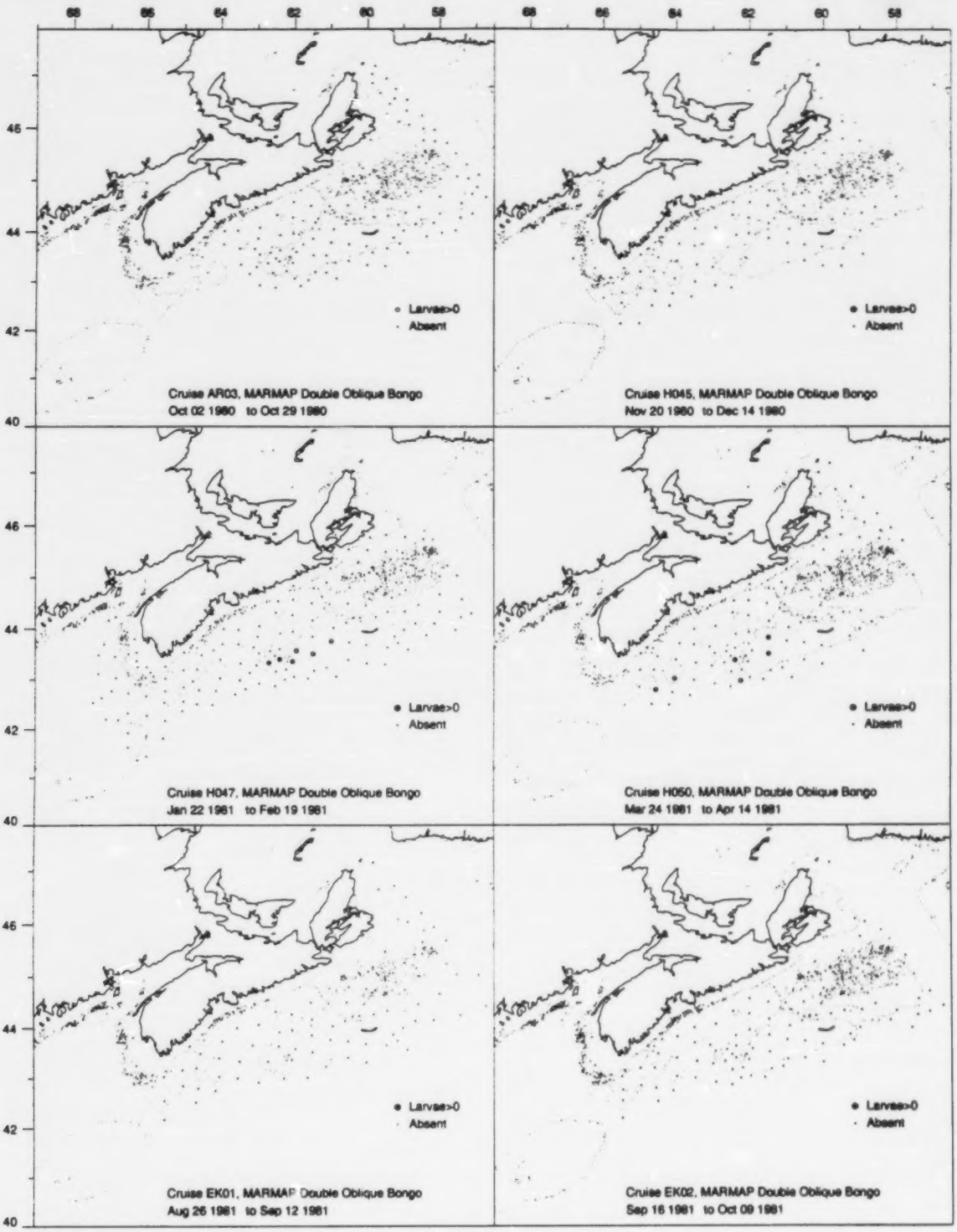

Fig. 8.4.6. (continued).

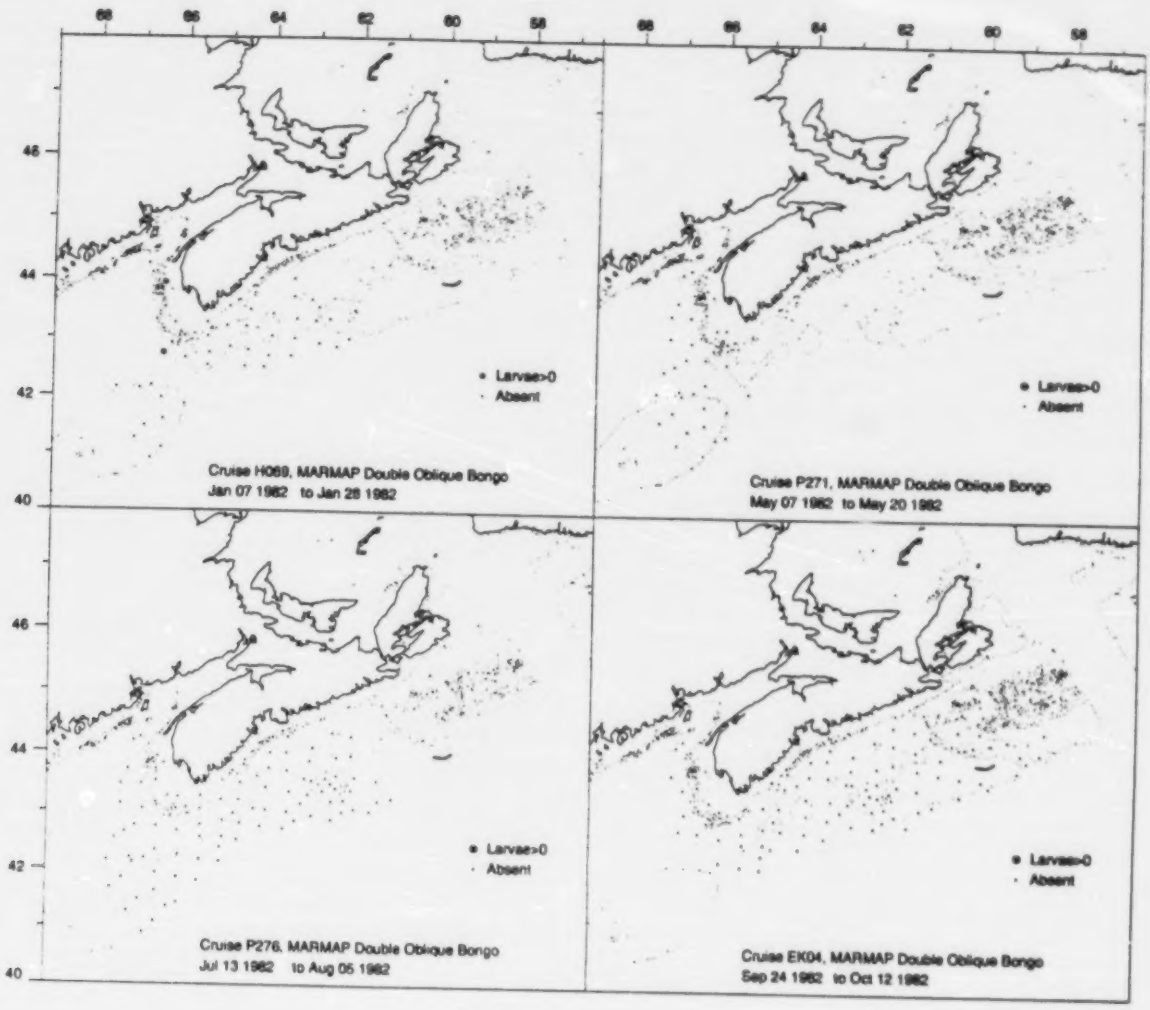

Fig. 8.4.6. (continued).